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(2) scientific and technical reports of government agencies, universities, and industrial and independent research organizations in the United States and abroad; and

(3) scientific and technical articles prepared by NASA and contractor authors which appear in learned and technical journals.

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A Semimonthly Publication
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Gordon N. Patterson et al Oct. 1962 232 p 62 refs

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N63-10683 National Research Council of Canada, Ottawa
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N63-10765 Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena
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S. L. Kresser and R. J. Sippel Oct. 15, 1962 77 p 287 refs
(NASA CONTRACT NAS7-100)
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This bibliography has been divided as follows: author index, summary publications, astronautics information, numerical index, and subject index. J.R.C.

N63-10912 Society of Aerospace Material and Process Engineers, Azusa, Calif.
NATIONAL SYMPOSIUM ON EFFECTS OF SPACE ENVIRONMENT ON MATERIALS, ST. LOUIS, MAY 7, 8, AND 9, 1962
St. Louis McDonnell Aircraft Corp. [1962] 606 p 349 refs

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N63-10939 Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena
SPACE PROGRAMS SUMMARY NO. 37-17, VOLUME IV FOR THE PERIOD AUGUST 1, 1962 TO OCTOBER 1, 1962. SUPPORTING RESEARCH AND ADVANCED DEVELOPMENT
Oct. 30, 1962 208 p refs
(NASA Contract NAS7-100)
(JPL Space Programs Summary 37-17, Vol. IV) OTS: $14.00 ph, $6.44 mf

This report covers material on the following: systems analysis, program engineering, experimental space science, chemistry, gas dynamics, physics, communications systems and elements, spacecraft secondary power and control, aerodynamic and environmental facilities, solid propellant engineering, polymer research, liquid propulsion, and advanced propulsion engineering. J.R.C.

N63-10953 Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena, Calif.
A BASIS FOR A SEPARATE TREATY FOR BANNING WEAPONS IN SPACE
Richard P. Schuster, Jr. Nov. 20, 1962 15 p
(NASA Contract NAS7-100)
(JPL-SM-40-1) OTS: $1.60 ph, $0.80 mf

This study memorandum describes one phase of research carried out under a special arms control and disarmament study project. Author

N63-10992 Joint Publications Research Service, Washington, D.C.
USSR—LAUNCHING PLATFORM TO THE UNIVERSE
Dec. 17, 1962 9 p Transl. from Nauchno-Tekhn. Obshchestva SSSR (Moscow), no. 9, Sept. 1962 p 2-5 *In its* Translations from Nauchno-Tekhnicheskiye Obshchestva SSSR (Scientific-Technical Societies, USSR), p 1-6
(JPRS-16718) OTS: $1.60

This paper discusses the role of the Soviet Union in the exploration of space and the significance of the Vostok-3 and -4 flights. It is noted that the rations for these flights consisted of normal foods (roast veal, sausage, etc.) prepared to the individual taste of the astronauts. R.C.M.

02 AERODYNAMICS OF BODIES, COMBINATIONS, AND INTERNAL FLOW

Includes: aerodynamics of channels, cowls, ducts, ejector nozzles, etc.

For related information see: 03 Aerodynamics of Wings, Rotors and Control Surfaces; and 11 Fluid Mechanics.

N63-10615 California U., Berkeley. Inst. of Engineering Research
AERO-FORCES ACTING ON A BLUNT BODY WITH SEPARATED FLOW
Yun-Sing Yuen (M.S. Thesis) Oct. 30, 1962 57 p 21 refs
(Contract Nonr-222(45))
(HE-150-203)

Normal and axial force coefficients were calculated theoretically for a blunt body—a hemispherically capped cylinder with a conic

skirt and a cylindrical afterbody of revolution. Concurrently, aerodynamic forces acting on a model of the same body type were measured in a supersonic, rarefied gas flow at a Reynolds number of 2260 per inch and nominal Mach number of 4.0. The experimental results, plotted in coefficient form, were compared to the theoretical predictions which consisted of Newtonian Hypersonic Theory with viscous corrections. Author

N63-10628 National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

STATIC STABILITY TESTS IN THE LANGLEY 24-INCH HYPERSONIC ARC TUNNEL ON A BLUNTED CONE AT A MACH NUMBER OF 20

Edwin F. Harrison Washington, NASA, Dec. 1962 22 p 7 refs
(NASA-TN-D-1508) OTS: $0.50

A compilation of experimental normal-force and pitching-moment coefficients is presented for a 9° semivertex-angle blunted cone at Mach numbers of 6.8, 9.6, 17, 17.3, 20, and 24 at angles of attack from −2.5° to 12.5°. The configuration had a truncated conical base and was designed as a 1/7-scale Scout project payload model. The investigation at a Mach number of 20 was the first force test conducted in the Langley 24-inch hypersonic arc tunnel. Author

N63-10629 National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio

PERFORMANCE OF SEVERAL INLET-BYPASS SYSTEMS FOR MATCHING A TWO-DIMENSIONAL VARIABLE-GEOMETRY MACH 3.0 INLET AT MACH 1.5 AND 2.0

Richard A. Yeager and Laurence W. Gertsma Washington, NASA, Mar. 1959 28 p 2 refs
(NASA-MEMO-2-6-59E)

The inlet, which had variable-angle second and third ramps, was matched to the specific off-design airflow requirements of an assumed engine by means of either a variable-size throat bypass or cowl bypass. On a net-thrust-minus-drag basis, the best performance at both Mach numbers was obtained with the cowl bypass configurations. The throat bypass configuration yielded performance nearly equal to that of the cowl bypass at Mach 2.0 but gave somewhat poorer performance at Mach 1.5. Author

N63-10666 Minnesota U. Rosemount Aeronautical Labs., Minneapolis

WIND TUNNEL INVESTIGATION OF A SPIKE-BLUFF BODY COMBINATION FOR A MONORAIL ROCKET SLED M = 2.0 TO M = 5.0

Rudolf Hermann, Frederick Moynihan, and Donald Olson Holloman AFB, N. Mex., Directorate of Research Analyses, Sept. 1962 113 p 5 refs
(Contract AF 29(600)-2839)
(RAL-RR-186; AFOSR/DRA-62-18)

Results of wind tunnel measurements of lift, drag and pitching moment on a circular cross-section monorail sled using a flow separation spike, including the influence of ground interference, are presented. Variables investigated were the spike length, spike diameter and location on a series of sled nose shapes. Mach number range was from 2 to 5. Author

N63-10673 Aro Inc., Arnold Air Force Station, Tenn.

THE DRAG OF SPHERES IN RAREFIELD HYPERVELOCITY FLOW

Max Kinslow and J. Leith Potter Arnold Engineering Development Center, Dec. 1962 56 p 36 refs
(Contract AF 40(600)-1000)
(AEDC-TDR-62-205)

Through use of the low-density, hypervelocity wind tunnel of the von Kármán Gas Dynamics Facility, drag of spheres has been measured under hypersonic, cold-wall ($T_w \ll T_o$), support-free conditions in a nonreacting (vibration frozen) flow. Data were obtained for a nominal free-stream Mach number of 11 and for Reynolds numbers from 1 to 10 based on conditions immediately downstream of the bow shock and sphere diameter. These data were supplemented by measurements at a nominal Mach number of 10 where a conventional balance was used, and Reynolds numbers downstream of the shock as high as 10^4 were investigated in the cold-wall condition. The experimental results have been analyzed both from the point of view of continuum flow with second-order viscous effects, and from the standpoint of a noncontinuum concept, taking account of first collisions between reemitted and free-stream molecules. Author

N63-10715 Army Ordnance Missile Command, Advanced Systems Lab., Redstone Arsenal, Ala.

THE EFFECT OF LOW ASPECT RATIO RECTANGULAR AND DELTA CRUCIFORM FINS ON THE STABILITY OF BODIES OF REVOLUTION WITH TANGENT OGIVES AT SMALL ANGLES OF ATTACK THROUGH A MACH NUMBER RANGE OF 0 TO 3.5

Clark De Jonge July 2, 1962 46 p 7 refs
(AOMC-RF-TR-62-1, Revised)

This report combines theoretical and experimental data to provide an easy method of estimating the static and dynamic stability of cylindrical bodies. Author

N63-10753 Princeton U., N. J.

THE FLOW ABOUT THE LEADING EDGE OF A SWEPT BLUNT PLATE AT HYPERSONIC SPEEDS

C. C. Horstman and I. E. Vas Wright-Patterson AFB, Ohio, Aeronautical Research Labs., Aug. 1962 45 p 18 refs
(Contract AF 33(616)-7629)
(ARL-62-405)

As part of a fundamental study of hypersonic wings, some detailed pressure distribution and heat-transfer results have been obtained over sections of the leading-edge region of a blunt plate at sweep angles from 0 to 75°. The tests were carried out at Mach numbers from 7 to 17. Some effects of the apex or upstream boundary of the plate on the leading-edge regions under study were determined at various stations along the leading edge. The leading-edge regions examined showed deviations from normal Mach number considerations at high sweep angles over the entire Mach number range studied. Author

N63-10763 Naval Missile Center. Aerodynamic Test Lab., Point Mugu, Calif.

CONCLUDING SUPERSONIC WIND TUNNEL TESTS ON EXPERIMENTAL STATIC PRESSURE PROBES

John B. Wainwright Oct. 31, 1962 8 p 2 refs
(Operated under Navy Contract by U. of S. Calif. Eng. Center)
(USCEC-65-50)

Supersonic wind tunnel tests are conducted on experimental static pressure probes. Pressure distribution measurements were made for blunted nose shapes and appropriate configurations at zero angle of attack and Mach numbers 1.61, 1.80, 2.25, 2.75, 3.0, 3.25, 3.40, 4.0, 4.25, 5.25, and 5.51. In addition, measurements were extended to 5, 10, 15, and 22 degrees angle of attack for some of the configurations considered. All angle-of-attack runs were made at zero roll angle, and thus there was no attempt to minimize the angle-of-attack effect with roll angle. It was found that for Mach numbers between 1.6 and 4.0 the level of pressure coefficient is near zero. J.R.C.

N63-10970 General Electric Co. Space Sciences Lab., Philadelphia, Pa.

ON THE BASE FLOW CHARACTERISTICS OF BLUNT AND SLENDER BODIES

K. S. Wan Nov. 1962 35 p 3 refs
(Contract AF 04(647)-617)
(R62SD96 - Class I)

An approximate method of solution is presented in this paper, which determines the location of the rear stagnation point in the viscous base-flow region together with the size of the viscous wake and the flow characteristics there. This is useful and necessary in obtaining the initial conditions for the near-wake calculations. In general, the results obtained show that one must consider the finite boundary layer at the base in determining the location of the rear stagnation point and the viscous wake width there. The viscous wake at the rear stagnation point most likely consists of a shell of hot gas surrounding a cool core. Results of both blunt and slender bodies under hypersonic conditions are compared and discussed. Author

03 AERODYNAMICS OF WINGS, ROTORS, AND CONTROL SURFACES

Includes: ailerons; airfoil sections; cascades; fans; flaps; propellers; rotors; slats; spoilers; etc.

For related information see: 02 Aerodynamics of Bodies, Combinations, and Internal Flow; and 11 Fluid Mechanics.

N63-10602 Hughes Aircraft Co., Culver City, Calif.

WAVE DRAG OF CLIPPED ARROW WINGS WITH MODIFIED DOUBLE-WEDGE SECTION Technical Memorandum

Arthur W. Rogers Oct. 1962 73 p 9 refs

(TM-615)

A derivation of the theoretical wave-drag coefficients for three-slope clipped-arrow wings is presented. The results of a previous report are extended to include wings whose leading edge, trailing edge, and ridge lines, extended, do not meet at a common point, and whose thickness decreases linearly spanwise to zero at the tip chord. The calculative procedure is outlined and sample results from an available computer program are presented. Author

N63-10800 National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

LOCAL PRESSURE DISTRIBUTION ON A BLUNT DELTA WING FOR ANGLES OF ATTACK UP TO 35° AT MACH NUMBERS OF 3.4 AND 4.7

Marvin Kussoy Washington, NASA, Dec. 1962 22 p 7 refs

(NASA-TN-D-1554) OTS: $0.75

The pressures on the windward surface of a delta wing, consisting of an elliptic paraboloid nose section and an elliptic cone afterbody, were investigated in air at Mach numbers of 3.4 and 4.7 and angles of attack up to 35°. The pressures obtained were compared with the predictions of two simple methods. In general, these methods bracketed the data, with the modified Newtonian flow and equivalent cone methods predicting pressures that were, respectively, lower and higher than those observed. Author

N63-10950 National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

TIME-DEPENDENT AIR FORCES ON WINGS WITH SUPERSONIC LEADING AND TRAILING EDGES AND SUBSONIC SIDE EDGES WITH APPLICATION TO A WING DEFORMING HARMONICALLY ACCORDING TO A GENERAL POLYNOMIAL EQUATION

Joseph A. Drischler Washington, NASA, Dec. 1962 63 p 21 refs

(NASA-TN-D-1475) OTS: $1.75

The integral form of the velocity potential and pressure distribution for a wing, with supersonic leading edges and subsonic side edges, in supersonic flow is derived herein for a wing undergoing any arbitrary time-dependent deformations. The expressions are simplified by assuming harmonic deformations and then expanding the integrand of the velocity potential to the third power of frequency. The special case was treated for which the side edge was parallel to free stream, and the oscillations were such that the wing distortion could be represented by a polynomial of any desired degree in the span coordinate and third degree in the chordwise coordinate. Author

04 AIRCRAFT

Includes: specific types of complete aircraft (e.g., Ground Effects Machines, Flexible Wings, STOL, and VTOL); flight tests; operating problems; stability and control.

For related information see: 02 Aerodynamics of Bodies, Combinations, and Internal Flow; 03 Aerodynamics of Wings, Rotors, and Control Surfaces; and 30 Space Vehicles.

N63-10624 National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

AN ANALYTICAL STUDY OF EFFECTS OF SOME AIRPLANE AND LANDING-GEAR FACTORS ON THE RESPONSE TO RUNWAY ROUGHNESS WITH APPLICATION TO SUPERSONIC TRANSPORTS

Norman S. Silsby Washington, NASA, Dec. 1962 26 p 11 ref

(NASA-TN-D-1492) OTS: $0.75

Speeds investigated covered a range from 40 to 280 feet per second. Assumptions made for the analysis were (1) natural frequency of all tires were the same, (2) tires had no damping and possess a linear tire-deflection load curve, (3) all struts had linear damping and spring characteristics, and natural frequency and damping of all struts were the same, (4) rigid airplane structure, and (5) no aerodynamic forces. Parameters which were varied included gear wheel base, location of center of gravity, and radius of gyration. Author

05 ASTRONOMY AND ASTROPHYSICS

Includes: celestial mechanics; and radioastronomy.

For related information see: 12 Geophysics; and 29 Space Sciences.

N63-10596 National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

CONTINUOUS ABSORPTION IN THE SOLAR ATMOSPHERE BY THE QUASI-H_2 MOLECULE

Theodore P. Stecher Repr. from Astrophys. J., v. 136, no. 2 Sept. 1962 p 686-687 8 refs

This note points out that most or all of the unknown continuous absorption in the solar atmosphere is due to the quasi-hydrogen molecule. The absorption coefficient for the electronic transition suggests the possibility of obtaining a good boundary temperature for the sun by means of rocket and satellite limb-darkening observations. It is pointed out that the presence of quasi-molecules as a source of opacity in the sun lends support to the suggestion that quasi-molecules formed from hydrogen and helium atoms and ions are the cause of the large ultraviolet flux deficiency in the hotter stars. J.R.C.

N63-10769 National Aeronautics and Space Administration. Washington, D. C.

THE MAGNETIC FIELD OF THE CRAB NEBULA AND ITS CENTRAL STAR (MAGNITNOYE POLE KRABOVIDNOY TUMANNOSTI I TSENTRAL'NOY ZVEZDY)

S. B. Pikel'ner (Crimean Astrophys. Obs., USSR Acad. of Sci.) Nov. 1962 28 p 26 refs Transl. from Astron. Zh. (Moscow), v. 33, no. 6, 1956 p 785-799
(NASA-TT-F-112) OTS: $0.75

This paper includes discussions of the following subdivisions: observations of polarization, estimation of the field from the spectrum form, estimation of the field from energy density, distribution of optical and radio emission, estimating the mass of the envelope, influence of the expansion of the envelope on the spectrum of the particles, the nature of the field, and the magnetic field of the star. Author

N63-10772 Brookhaven National Lab., Upton, N.Y.

GALAXIES

Otto Struve (National Radio Astronomy Observatory) Jan. 17, 1962 19 p
(Its Lectures Series 13; BNL-710(T-247)) OTS: $0.50

General information on famous galaxies is presented and the enormity of the distances that constitute the observable part of the universe—up to ten billion light years—is stressed. Two rival theories accounting for radio emission of peculiar galaxies are compared. Baade and Spitzer believe that although a collision of one particular galaxy in the universe with some other neighboring galaxy is a rare event, the number of galaxies throughout the observable volume of space is so large that many galaxies must have undergone collisions and some may be in collision at the present time. When a collision actually takes place, the orbits of the stars of each galaxy are presumably slightly perturbed, but neither galaxy is destroyed as a result of the collosion. However, the gas and dust that may be present in the two galaxies would collide head on, producing turbulent motions that could perhaps be coverted into radio emission. The other theory, advanced by Burbidge, is based upon the recognition that the supergalactic clusters in the nuclei of spiral and elliptical galaxies may not provide a reliable estimate of the maximum star density in the innermost regions of these nuclei. An old star belonging to an immensely dense hypothetical cubic parsec inside a galactic nucleus might in the course of its evolution blow up as a supernova. An appreciable amount of energy of the explosion would be absorbed by the nearest stellar neighbor, thus initiating a process of supernova explosions throughout the superdense cubic parsec. A supernova presumably has a greater probability of exploding in the outer regions of a galaxy where its own nearest stellar neighbors are relatively immune to the consequences of such an explosion. Such a supernova may temporarily appear as an optically luminous object, sometimes rivaling in brightness the optical brightness of the entire galaxy itself, and it would also produce a small additional amount of radio emission which would gradually die out as the supernova shell continued to expand. Much has been written about these two rival theories but no final conclusion acceptable to all astronomers has as yet been reached. P.F.E.

N63-10796 National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

CALCULATION OF EPHEMERIDES FROM INITIAL VALUES

Karl Stumpff Washington, NASA, Dec. 1962 28 p
(NASA-TN-D-1415) OTS: $0.75

A method is presented for calculating undisturbed ephemerides (coordinates of location and velocity) of a planet or a comet when its initial time values are given. The orbital elements need not be known for this method, which is applicable, without formal variations, for all types of orbits. The singularity of classical methods is avoided by the transfer from elliptical to hyperbolic orbits. In place of Kepler's equation, a transcendent *main equation* appears. It is valid for all types of orbits and becomes rational for circular and parabolic orbits. The formulas for the calculation of location and velocity coordinates are simple and well suited for electronic computers. The optimal area for application (small and medium intermediate times) coincides with the requirements for orbit determination, orbit correction, and the calculation of special perturbations. Author

N63-10862 Congress. House. Committee on Science and Astronautics

RADIO AND RADAR ASTRONOMY Hearings before the Subcommittee on Applications and Tracking and Data Acquisition of the Committee on Science and Astronautics, U.S. House of Representatives, Sept. 24 and 25, 1962

John Wilson Findlay et al Washington, GPO, 1962 79 p Contains Report of the Advisory Panel on Radio Telescopes by Geoffrey Keller (Nat. Science Found.) p 20-32 2 refs Previously published in the Astrophys. J., v. 134, no. 3, Nov. 1961
(87th Cong. 2nd Sess. Committee Print [No. 14])

This paper contains the records of the hearings on tracking and data acquisition and the following reprints: Report of the Advisory Panel on Radio Telescopes; Scatter Radar Investigation of the Upper Atmosphere and Solar System; Space Telecommunication and the Frequency Allocation Problem; Topside Sounder Experiment; Space-Related Activities of the Radio Standards Laboratory; and Space-Related Activities of the Cryogenic Engineering Laboratory. R.C.M.

N63-10961 California Inst. of Tech., Pasadena

SYNCHROTRON RADIATION AS THE SOURCE OF JUPITER'S POLARIZED DECIMETER RADIATION

David B. Chang and Leverett Davis, Jr. Repr. from Astrophys. J., v. 136, no. 2, Sept. 1962 p 567-581 20 refs For abstract see N62-11455 05-28
(NASA Grant NsG-151-61)

Formulae are given for the synchrotron radiation from a shell of relativistic electrons in a dipole field. The results obtained by evaluating these formulae by digital computer for 13 cases are presented in tables showing the intensity and polarization of the radiation in 10 zones parallel to the dipole axis. Fourier transforms of the intensity and polarization for directions parallel and normal to the dipole axis are also tabulated. The partially polarized decimetric radiation observed to come from Jupiter could be obtained from such electron shells, provided that a large number of electrons have relatively flat helices. Magnetic fields of the order of 0.1 to 1 gauss in the emitting region and about sixty times as much at the poles are required. The electrons must have energies in the 5 to 75-Mev range and densities of the order of 10^{-3} to 10^{2} cm^{-3}. The problem of obtaining high-energy, flat-helix electrons in the planetary magnetic field is briefly considered. Author

N63-10973 Joint Publications Research Service, Washington, D.C.

RADAR OBSERVATIONS OF VENUS

V. A. Kotel'nikov (Inst. of Radio Eng. and Electron., USSR Acad. of Sci.) et al Dec. 17, 1962 9 p 7 refs Transl. from Doklady Akad. Nauk SSSR (Moscow), v. 145, no. 5, 1962 p 1035-1038
(JPRS-16728) OTS: $1.10

A number of organizations conducted radar observations of the planet Venus in April 1961. An analysis of the spectrum of reflected signals showed that they can be represented as the sum of two components, i.e., of a narrow-band and of a broadband one. The width of the narrow-band component was fixed by the amplitude modulation of the emitted signals and was not more than several hundred cps. The width of the broadband was several hundred cps. Comparing the energy of the narrow-band component with the energy which was picked up by the receiver from the discrete source, Cassiopeia A radio stars, it was established that this component contained 8% of the energy that would have been intercepted had Venus been a smooth, well-conducting sphere. Two possible variants are examined: (1) The wide-band component forms as a result of a signal's reflection from the entire surface of Venus and as a result of the Doppler shift caused by its rotation; (2) The reflecting properties of Venus are about the same as at the Moon. By analogy with the Moon, the narrow-band component of the reflected signal should correspond to a reflection from a spot having 1/10 of the radius of Venus. From this data a period of rotation totaling more than 100 days is determined.

In this variant, the wide-band component can by no means be explained by the reflection from the planet's surface, and it should be postulated that it occurred as a result of reflection from some kind of formations moving at velocities up to ±40 meters per second relative to Venus or even faster, for example, reflections from highly ionized streams. But for this to be so, the ionization in these streams would have to be much greater than in the Earth's ionosphere. P.F.E.

N63-10997 California U., Berkeley. Space Sciences Lab.
A POSSIBLE ORIGIN OF THE LUNAR WALLED PLAIN, PTOLEMAEUS
Robert G. Strom and A. Palm Oct. 15, 1962 15 p 18 refs
(NASA Grant NsG-145-61)
(*Its* Ser. 3, Issue 24) OTS: $1.60 ph, $0.80 mf

The tectonic associations between the diverse features in Ptolemaeus and the regional radial and parallel grid systems have been investigated. On the basis of this analysis, it has been concluded that Ptolemaeus represents a collapse feature and that it underwent a protracted development. Author

06 AUXILIARY SYSTEMS

Includes: fuel cells and solar cells; gas turbines; hydraulic, pneumatic and electrical control systems and actuators; and inverters.

For primary propulsion systems see: PROPULSION

For related information see: 08 Communications; 09 Electronics; 10 Facilities; 15 Instrumentation; and 22 Navigation and Guidance.

N63-10586 Naval Research Lab., Washington, D. C.
STATUS REPORT ON THERMOELECTRICITY [Ninth Quarterly Review, Part I]
J. W. Davisson, Joseph Pasternak, and B. B. Rosenbaum Oct. 1962 138 p refs
(NRL-Memo-1361)

This report on thermoelectricity covers the following: materials research development, the thermoelectric properties of some cerium sulphide semiconductors, thermoelectric power generation, high temperature broadband semiconductors, semiconducting compounds for thermoelectric power generation at high temperature, structural investigations in thermoelectric materials, high temperature semiconduction compounds for thermoelectric power generation, development of a semiconductor film type thermocouple converter, physical properties of materials important to thermoelectric energy conversion, the statistical variation of thermoelectric parameters of lead telluride, thermoelectric parameters of refractory oxides, optimization of thermoelectric energy converters, and characteristics and annealing of neutron irradiated PbTe. J.R.C.

N63-10588 Thompson Ramo Wooldridge, Inc. TAPCO Div., Cleveland, Ohio
THE SNAP II POWER CONVERSION SYSTEM. TOPICAL REPORT NO. 15: CRU DESIGN AND DEVELOPMENT
Oct. 1962 103 p 2 refs
(Contract AT(11-1)-GEN-8; Atomics International Subcontract N843FS-101221)
(ER-4108; NAA-SR-6307)

SNAP II is the designation for a 3-kw nuclear auxiliary power unit to be used in a satellite vehicle. This system consists of a reactor heat source, a mercury Rankine engine, and an alternator. The alternator, mercury pump, turbine, and reactor coolant pump are mounted on a common shaft supported by mercury lubricated bearings. Design details and test results of combined-rotating-unit (CRU) development are described in this report. Author

N63-10616 National Research Corp., Cambridge, Mass.
DEVELOPMENT OF A PHOTOEMISSIVE SOLAR ENERGY CONVERTER [Final] Technical Documentary Report [June 1961-May 1962]
Peter Fowler, Lewis R. Koller, and Martin P. Schrank Wright-Patterson AFB, Ohio, Directorate of Aeromechanics, Sept. 1962 86 p 27 refs
(Contract AF 33(616)-8415)
(ASD-TDR-62-600)

The characteristics of a photoemissive solar energy converter were studied. The practical form of this device is a perforated sheet of a dielectric such as polyethylene terephthalate resin coated on one side with a photoemitter and on the other with a low work function conductor. Photoelectrons emitted from the front surface by solar radiation fall back through the holes and are collected on the back surface. The resulting charge transfer builds up a potential difference which may be used to perform useful work. Models were constructed and tested in evacuated glass envelopes of ultraviolet transmitting glass using a xenon arc as a solar simulator. The observed power conversion efficiency was of the order of 10^{-4} %. There was no correlation between converter efficiency and geometrical parameters. Measurements of spectral response showed good agreement with published values for Cs_3Sb. Life tests did not show any deleterious effects due to the evaporation which would be expected to occur in space. Calculation of rates of evaporation indicated a life of 0.8 year at 27° C and 70 years at 0° C. The effect of oblique incidence was found by experiment to be a decrease in output at a lower rate with respect to angle of incidence than would be predicted by the cosine law. It was found that Cs-Sb surfaces can be formed at temperatures considerably below 120° C by a co-deposition of cesium and antimony. Author

N63-10707 Harshaw Chemical Co. Solid State Research and Electronics Div., Cleveland, Ohio
RESEARCH ON SOLAR-ENERGY CONVERSION EMPLOYING CADMIUM SULFIDE [Summary Report, July 1960 through Dec. 1961]
Fred A. Shirland, G. A. Wolff, and John D. Nixon Wright-Patterson AFB, Ohio, Flight Accessories Lab., June 1962 83 p 25 refs
(Contract AF 33(616)-7528)
(ASD-TDR-62-69)

Application of semiconductive CdS to photovoltaic energy conversion has been continued with primary emphasis on cells fabricated from vacuum evaporated CdS films. Back wall CdS film cells on conducting glass substrates have given conversion efficiencies up to 5% on small areas. Front wall CdS film cells on molybdenum foil substrates have given conversion efficiencies up to 2.5% on small areas and up to 1.0% on larger areas of 9 in^2. Thin, light-weight arrays have been constructed from these latter cells giving power-to-weight ratios up to 10 watts per pound. Possible improvements, promising increases of the ratio up to 30 to 40 watts per pound, are discussed. Arrays of CdS film cells of 1 square-foot area have been constructed. Fundamental investigations were initiated on the growth, annealing, etching, and orientation of CdS single crystals and films. Author

N63-10744 Sundstrand Aviation-Denver. Engineering and Testing Lab., Pacoima, Calif.
A FEASIBILITY STUDY OF A THIONINE PHOTOGALVANIC POWER GENERATION SYSTEM. Technical Documentary Report [Mar. 1961 - Feb. 1962]
L. J. Miller Wright-Patterson AFB, Ohio, Flight Accessories Lab., May 1962 234 p 75 refs
(Contract AF 33(616)-7911)
(ASD-TDR-62-373)

A feasibility study was made of the thionine photogalvanic system for converting solar energy to electrical energy. Theoretical and experimental investigations have been made to determine the maximum voltage and power available from the system. The effects of operating conditions as well as solution composition variables on cell performance have been studied. Cell voltages up to 220 mv and power levels up to 1.8 μ watts were obtained. Estimates of the power, weight, and cost of a photogalvanic cell have been made on the basis of present knowledge. Author

07 CHEMISTRY

Includes: chemical analysis and identification (e.g., spectroscopy); chemical engineering; chemical properties of materials; and synthesis.

For related information see: 18 Materials, Metallic; 19 Materials, Non-metallic; and 26 Propellants and Combustion.

N63-10577 Joint Publications Research Service, Washington, D. C.
EFFECT OF THE NATURE OF THE ADSORBENT, NONUNIFORMITY OF SURFACE, AND ADSORBATE-ADSORBATE INTERACTION IN THE ADSORBTIVE PROPERTIES OF SOLIDS
A. V. Kiselev Nov. 29, 1962 26 p Transl. of article from Vestn. Mosk. Univ., Ser. II: Khim. (Moscow), no. 1, 1962 p 3-20
(JPRS-16405) OTS: $2.60

Adsorption phenomena are discussed to point out the possibilities for the development of a modern theory of adsorption. The heats of adsorption on graphitized carbon blacks and on nonuniform surfaces are compared, and theoretical calculations are made of the potential energy of adsorption. It is concluded that by the unification of these studies with investigations with isotope exchange, spectroscopy, and magnetic resonance, a new theory of adsorption could be developed. R.C.M.

N63-10578 Joint Publications Research Service, Washington, D. C.
PHYSICO-CHEMICAL INVESTIGATIONS OF THE SiC-B_4C SECTION OF THE Si-B-C-SYSTEM
A. A. Kalinina and F. I. Shamray Nov. 29, 1962 10 p 6 refs Transl. from Tr. Inst. Met. im. A. A. Baikova, Adak. Nauk. SSSR (Moscow), no. 5, 1960 p 151-155
(JPRS-16409) OTS: $1.10

A study is made of the SiC-B_4C section of the ternary system Si-B-C. Samples were obtained by the hot pressing method with a porosity not exceeding 10%. Powdered silicon, boron, and additional silicon and boron carbides were used as the starting materials. Phase X-ray analysis was conducted by the Debye powder method, while the Zags reverse reflection method was used for determining the parameters of the lattice. Phase chemical analysis was based on the selective oxidation of the alloys with the subsequent dissolution of the oxidation phase in water acidified with hydrochloric acid. The investigation allowed the determination of the character of the processes occurring during the interaction of boron and carbon and silicon in the section SiC-B_4C of the system Si-B-C. The section SiC-B_4C of the system of Si-B-C is a quasi-binary one formed by solid solutions with a limited solubility. J.R.C.

N63-10580 Air Force Systems Command. Foreign Technology Div., Wright-Patterson AFB, Ohio
HETEROLYTIC CONVERSIONS OF POLYFLUORINATED AZOALKANES
V. A. Ginsburg, A. Ya. Yakubovich, A. S. Filatov, G. Ye. Zelenin, S. P. Makarov, V. A. Shpanskiy, G. P. Kotel'nikova, L. F. Sergiyenko, and L. L. Martynova Sept. 5, 1962 8 p 3 refs Transl. from Doklady Akad. Nauk SSSR (Moscow), v. 142, no. 2, 1962 p 354-357
(FTD-TT-62-1070/1+2+4)

Heterolytic cleavage and addition reactions of polyfluorinated azoalkanes are presented along with the properties of the reaction products. The reactions covered include those with hydrogen iodide, with the dienes, and with grignard reagents. R.C.M.

N63-10581 Gt. Brit. Ministry of Aviation. Technical Information and Library Services, Nottingham
THE MELTING OF MIXED POLYETHYLENES (DAS SCHMELZEN VERMISCHTER POLYÄTHYLENE)
H. J. Orthmann and K. Ueberreiter Sept. 1962 17 p 12 refs Transl. from Z. Elektrochem. (Germany), vol. 61, p 106-113, 1957
(TIL/T.5331)

The effect of a solid diluent on the melting behavior of polyethylene was investigated, using mixtures of polyethylene with hexachlorodiphenyl, naphthalene, anthracene, n-C_{36} and the paraffins n-C_{18}-C_{36}, respectively. Characteristics of the melting phase diagrams are discussed, and methods of calculating intervals and lengths of amorphous regions by the Flory equations are described. Author

N63-10585 Union Carbide Nuclear Co., Oak Ridge, Tenn.
CATALYTIC GAS PLATING WITH NICKEL CARBONYL
W. E. Tewes, T. E. Zava, and T. B. Hoover Nov. 23, 1962 32 p 7 refs
(Contract W-7405-eng-26)
(K-1533) OTS: $0.50

Exploratory studies have been made to determine the value of four potential catalysts in increasing the gas plating rate for nickel carbonyl. The catalysts studied were anhydrous ammonia, water vapor, oxygen, and hydrogen sulfide. No catalytic effect was observed for either ammonia alone or for water vapor alone. Oxygen was not tested alone. With hydrogen sulfide present in the 0.2% to 0.4% concentration range, significant improvement in plating rate was observed. The best results were obtained with mixtures of hydrogen sulfide and water vapor or mixtures of hydrogen sulfide and oxygen, using hydrogen sulfide concentrations of 0.2% to 0.8%, water vapor concentrations of 0.03% to 0.08%, and oxygen concentrations of 0.8% to 1.0%. The catalytic effect can also be used to reduce the temperature required for gas plating with nickel carbonyl. Using the hydrogen sulfide-oxygen mixture, nickel carbonyl gas plating was performed at room temperature on the following materials: iron, copper, aluminum, glass, paper, cardboard, cotton cloth, and cork. Author

N63-10591 Gt. Brit. Ministry of Aviation. Technical Information and Library Services, Nottingham
DETERMINING THE MECHANICS OF CHEMICAL REACTIONS (DIE ERMITTLUNG DES MECHANISMUS CHEMISCHER REAKTIONEN)
M. Bodenstein Oct. 1962 17 p 25 refs Transl. from Helv. Chim. Acta (Basel, Switzerland), v. 18, 1935 p 743-759
(TIL/T-5327)

Typical mechanisms of reaction are discussed by taking such examples as the reactions of nitrogen, oxygen, bromine hydrides, halogen acids, and nitro-acids. The chemical kinetics of the reactions are described and the probable validity of each stage in the multistage reactions discussed. The value of the methods of preparative chemistry for reactions such as the combustion of ammonia is stressed. Author

N63-10593 Imperial Coll. of Science and Tech., London (Gt. Brit.)
PHOTOCHEMICAL REACTIONS IN THE ALKALI HALIDES Technical Report No. 1
P. W. M. Jacobs and Lina Ben-Dor Oct. 1962 23 p 4 refs
(Contract N62558-2862)

The rates of gas evolution from potassium chloride in the form of fine crystals, ground powder, and single crystals, of varying purity, have been measured and the quantum yields evaluated. Comparative experiments using AgCl have shown that the gaseous products from two substances are identical but that, although containing chlorine, they consist largely of hydrogen. A mechanism involving the exchange of chlorine with hydrogen in the OH groups of the hydrated silica forming the interior surface of the glass walls is proposed to account for this. Measurements of the rates of gas evolution, with and without a water filter, have confirmed that a substantial amount of the reaction is caused by the 2537 Å mercury resonance line. Possible mechanisms for the photolysis are discussed. Author

N63-10594 Stanford Research Inst., Menlo Park, Calif.

THE KINETICS OF DECOMPOSITION OF LIQUID AMMONIUM NITRATE. II. THE DECOMPOSITION OF NH_4NO_3 CATALYZED BY CHROMIUM COMPOUNDS

Willis A. Rosser, S. Henry Inami, and Henry Wise [1961] 23 p 10 refs

(Supported by the Office of Naval Research)

The effect of chromium compounds on the decomposition of liquid NH_4NO_3 has been studied in the temperature range from 460° to 520° K. Chromium compounds soluble in liquid NH_4NO_3 were found to be effective catalysts. For low concentrations of catalyst, the principal products of decomposition are N_2, N_2O, H_2O, and HNO_2^-. The catalyzed decomposition, like the uncatalyzed decomposition, is inhibited by NH_3 and H_2O, and promoted by HNO_3. Author

N63-10595 Stanford Research Inst., Menlo Park, Calif.

THE KINETICS OF DECOMPOSITION OF LIQUID AMMONIUM NITRATE. I. THE UNCATALYZED DECOMPOSITION

Willis A. Rosser, S. Henry Inami, and Henry Wise [1961] 21 p 18 refs

(Supported by Office of Naval Research)

The kinetics of decomposition of liquid ammonium nitrate were studied in the temperature range 498° to 548° K. The principal products of decomposition, N_2O and H_2O, are accompanied by NH_3 and HNO_3 which result from dissociation. Both NH_3 and H_2O inhibit decomposition, while HNO_3 promotes decomposition. Consequently, the observed rate of decomposition depends on the composition and pressure of the gas in contact with the liquid ammonium nitrate. A reaction mechanism is proposed. Author

N63-10606 Gt. Brit. Ministry of Aviation. Technical Information and Library Services, Nottingham

THE ISOMERISM OF DINITROGENTETROXIDE: THE KINETICS OF THE REACTION OF NITROGEN DIOXIDE WITH HYDRAZOIC ACID IN THE GAS PHASE (ZUR FRAGE DER ISOMERIE DES DISTICKSTOFFTETROXIDES: KINETIK DER UMSETZUNG VON STICKSTOFFDIOXID MIT STICKSTOFFWASSERSTOFFSAURE IN DER GAS PHASE)

F. Seel, W. Birnkraut, and E. Lange Nov. 1962 9 p 12 refs Transl. from Chem. Ber., v. 94, no. 6, 1961 p 1436-1442

(TIL/T-5369)

The kinetics of the reaction of nitrogen dioxide with gaseous hydrazoic acid in the temperature range from 20° to 50° C was spectrophotometrically investigated. The reaction takes place in the second order with reference to NO_2 and the first order with reference to N_3H. The negative temperature coefficient of its speed points to a preliminary exothermal equilibrium. For the reaction of "normal N_2O_4" with hydrazoic acid, the activation energy of 3.2 kcal/mol can be calculated with the aid of the dissociation constant of dinitrogentetroxide. The stoichiometry of the reaction and the anomalous Arrhenius factor, however, indicate that nitrogen dioxide does not react through the symmetrical dinitrogentetroxide present in the NO_2/N_2O_4 equilibrium, but through the isomeric molecular form $ONONO_2$ (nitrosyl nitrate). Thermodynamic data with regard to the equilibrium between the two isomers can be estimated. Author

N63-10651 Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena

THERMODYNAMIC PROPERTIES OF NITRYL FLUORIDE

E. Tschuikow-Roux Sept. 1962 5 p 21 refs Repr. from J. Phys. Chem., v. 66, p 1636-1639

(NASA Contract NAS7-100)

(JPL-TR-32-253)

The thermodynamic functions of FNO_2 have been calculated from 200° to 1200° K from spectroscopic data using the rigid-rotator-harmonic-oscillator approximation. These functions, together with a recently communicated value for the heat of formation of nitryl fluoride, are used to evaluate the free energy, enthalpy, entropy, and equilibrium constants for several possible reactions of nitryl fluoride. The N-F and N-O bond energies in FNO_2 are calculated to be 44.7 and 61.3 kcal/mole, respectively. Author

N63-10699 Cornell U. Graduate School of Aerospace Engineering, Ithaca, N. Y.

STUDIES WITH A SINGLE PULSE SHOCK TUBE. I. THE *CIS-TRANS* ISOMERIZATION OF BUTENE-2 Technical Report

E. L. Resler, Jr., S. H. Bauer, and Assa Lifshitz Oct. 1962 31 p

(Contract AF 49(638)-716)

(CU-7356)

The *cis-trans* isomerization of butene-2 was investigated behind reflected shocks in a single-pulse shock tube of a novel design. The temperature range covered was 1000° to 1250° K, and concentrations of 1% and 6% of the butene in argon were used. Analyses were made by vapor-phase chromatography. The first order rate constants obtained in this work fall slightly above the extrapolated Arrhenius curves of two low-temperature studies. An activation energy of 65, rather than 62.8 kcal/mole, is obtained when a straight line is drawn between the high- and the low-temperature data. The rate constant obtained is $k_{cis}^{\rightarrow} = 3.5 \times 10^{14} \exp(-65 \times 10^3/RT)$. Possible sources of errors in evaluating reaction times in the single-pulse shock tube are discussed. Author

N63-10703 Rensselaer Polytechnic Inst., Troy, N. Y.

A MOLECULAR THEORY OF THE VISCO-ELASTICITY OF A THREE-DIMENSIONAL HYDROGEN-BONDED NETWORK

S. S. Sternstein and A. H. Nissan Repr. from the Formation and Structure of Paper Transactions of the Oxford Symposium, 1961 p 319-350 10 refs London, Technical Section of the British Paper and Board Makers' Association, Inc. [1961]

(NASA Grant NsG-100-60)

A stress-strain law is derived for a hydrogen-bonded network that is isotropic for all strains. The calculus of variations is used in conjunction with the Principle of Least Work to obtain the distribution of strain among the hydrogen bonds of the system as a function of their orientation. In addition to unidirectional applied stress, the theory can be used to predict the effects of two- and three-dimensional tension. The solution for unidirectional strain is compared with a modified form of the original treatment of the theory by Nissan, and experimental evidence is used to corroborate the postulate that these two solutions 'bracket' the stress-strain behavior for anisotropic (oriented) systems. Author

N63-10709 Rensselaer Polytechnic Inst., Troy, N. Y.

ORTHO AND PARATRITIUM

Edwin W. Albers, Paul Harteck, and Robert R. Reeves, Jr. Nov. 30, 1962 16p 8 refs Prepared for journal publication

(NASA Grant NsG-158-61)

OTS: $1.60 ph, $0.80 mf

Normal tritium was partially and totally converted to paratritium by adsorption of normal tritium on charcoal at liquid-neon and liquid-helium temperature. The experimentation was performed with 300 millicuries of tritium sealed in a small glass apparatus where the transformation could be performed and the paratritium concentration measured by thermal conductivity. In the adsorbed phase, the conversion

half-life time was one minute, about 24 times faster than normal hydrogen. In the solid phase the conversion half-life was in the order of 15 minutes. Author

N63-10737 Rensselaer Polytechnic Inst., Troy, N.Y.
CELLULOSE AS A VISCOELASTIC MATERIAL
A. H. Nissan and S. S. Sternstein Repr. from Pure Appl. Chem., v. 5, 1962 p 131-146 23 refs
(NASA Grant NsG-100-60)

The hydrogen bond theory is applied to the viscoelastic behavior of cellulose and compared to experimental data. Equations are derived for both the one- and three-dimensional theories of hydrogen bonding. The energy of activation found by these equations is 21.2 kcal which is comparable to 25 kcal determined experimentally. R.C.M.

N63-10741 Directorate of Materials and Processes, Aeronautical Systems Div., Wright-Patterson AFB, Ohio
VACUUM TECHNIQUES IN RADIATION CHEMISTRY [Final] Technical Documentary Report [Jan. 1960-June 1961]
Roger E. Rondeau July 1962 31 p 4 refs
(ASD-TDR-62-575)

This report describes the high-vacuum apparatus and methods used in the radiation-chemical studies of organic compounds. The design and use of high-vacuum systems for the purification, degassing, filling, and sealing of irradiation ampoules are explained. The post-irradiation techniques of removal, separation, measurement, and collection of the volatile products of radiolysis are also described. Author

N63-10863 California U., Berkeley. Lawrence Radiation Lab.
MATRIX ISOLATION STUDIES OF HIGH-TEMPERATURE SPECIES GROUP II CHLORIDES
Raymond W. McNamee, Jr. (Ph. D Thesis) Sept. 13, 1962 79 p 32 refs
(Contract W-7405-eng-48)
(UCRL-1045; UC-4)

A matrix isolation technique for the investigation of infrared absorption spectra of molecules of high-temperature species, trapped in a "pseudo-gas phase," is described. The spectra of the dichlorides of zinc, cadmium, and mercury in argon, krypton, and xenon matrices are reported. Presence in the gas phase of dimers of zinc chloride and mercuric chloride are noted. An absorption band, previously reported as due to the degenerate bending motion of zinc chloride, is attributed to zinc dimer. Author

N63-10872 California U., Berkeley. Lawrence Radiation Lab.
A MOLECULAR-BEAM ELECTRIC-RESONANCE SPECTROMETER AND THE RADIO-FREQUENCY SPECTRA OF LITHIUM FLUORIDE
Alvin Joseph Hebert (Ph. D. Thesis) Sept. 26, 1962 89 p 46 refs
(Contract W-7405-eng-48)
(UCRL-10482) OTS: $2.00

The construction and operation of a radio-frequency electric-resonance molecular beam apparatus are described. The resolution of the apparatus is consistent with theoretical expectations. A simple mass spectograph and an automated counting-recording scheme allow the procurement of spectra from signals that correspond to as few as one hundred detected transitions per second. The experimental results obtained for lithium fluoride are presented and discussed. Author

N63-10887 Avco-Everett Research Lab., Everett, Mass.
SHOCK TUBE STUDY OF THE RECOMBINATION OF O-ATOMS BY Ar CATALYSTS AT HIGH TEMPERATURES
Kurt L. Wray Sept. 1962 26 p 19 refs
(Contract DA-19-020-ORD-5476)
(Avco-Everett Res. Rept.-142)

The three-body recombination of O-atoms by Ar catalysts was measured over a temperature range of 1340° to 2920° K in a shock tube experiment. The experimental results are compared with calculated curves based on various authors' dissociation rate constants divided by the equilibrium constant. A dissociation rate constant given by $K_d = 2.5 \times 10^{16}\ T^{-1/2} \exp(-D/RT)$ cc/mole-sec, which is shown to fit dissociation data obtained in previous work and covering a temperature range of 5000° to 18,000° K, was found to best fit the present recombination data. Author

N63-10893 Naval Ordnance Lab., White Oak, Md.
RATE AND MECHANISM OF PYROLYSIS OF POLYBENZYL
Hugh C. Anderson Oct. 1962 18 p 11 refs
(NOLTR-62-59)

The thermal decomposition of polybenzyl was investigated, thermogravimetric measurements being used to calculate its rate of pyrolysis, and gas chromatography and infrared spectrometry being used to determine the products of decomposition. Polybenzyl was found to decompose with an activation energy of 45.4 kcal/mole. Its products of decomposition comprised about 96% of substances involatile in vacuo at 25° C and 4% of a mixture of benzene, toluene and xylene. That the amount of toluene produced was four times that of benzene is attributed to the benzyl radical having a greater resonance stabilization energy than a phenyl radical. Author

08 COMMUNICATIONS

Includes: communications equipment and techniques; noise; radio and communications blackout; telemetry; tracking; and wave propagation.

For tracking stations see: 10 Facilities.

For related information see: 06 Auxiliary Systems; 09 Electronics; 15 Instrumentation; and 22 Navigation and Guidance.

N63-10637 Illinois U. Antenna Lab., Urbana
THE BACKFIRE BIFILAR HELICAL ANTENNA
Willard Thomas Patton Sept. 1962 122 p 23 refs
(Contract AF 33(657)-8460)
(Tech. Rept. 61)

A theoretical analysis of the bifilar helical antenna is obtained. It is based upon the semi-infinite model using thin-wire assumptions. The Fourier transform of the current distribution on the semi-infinite helix is deduced from the determinantal equation of the bifilar helical waveguide by a Wiener-Hopf technique. The relation between this Fourier transform and the radiation pattern of the backfire bifilar helical antenna is shown. The results predict the patterns of the experimental study and show the effect of wire size on antenna performance. Author

N63-10642 Smithsonian Astrophysical Observatory, Cambridge, Mass.
OPTICAL SATELLITE TRACKING PROGRAM Semi-annual Progress Report No. 6, Jan. 1 through June 30, 1962
Fred L. Whipple [1962] 48 p 28 refs
(NASA Grant NsG-87-60)
OTS: $4.60 ph, $1.64 mf

The Satellite Tracking Program Department was reestablished in August 1961 to coordinate the Station Operations and the Moonwatch, Photoreduction, and Data Processing Divisions and to direct their combined efforts to provide the data required for the Research

and Analysis Division. During this report period, the Observatory had tracking responsibility and issued regular ephemerides for thirteen satellites. Author

N63-10667 Naval Research Lab., Washington, D. C.

A TECHNIQUE FOR NARROW-BAND TELEMETRY OF NONRECURRENT PULSES

J. E. Abel and P. T. Stine Oct. 26, 1962 28 p 22 refs
(NRL-5846)

A pretransmission data-processing technique has been developed to meet several unusual telemetering requirements. The technique has been implemented and the performance of a laboratory model has verified the validity of the technique. Author

N63-10672 New York U. Coll. of Engineering, N. Y.

THE ESTIMATION PROBLEM IN NULL-ZONE RECEPTION FEEDBACK SYSTEMS Eleventh Scientific Report

J. J. Metzner and K. C. Morgan Aug. 15, 1962 146 p 26 refs
(Contract AF 19(604)-6168)
(AFCRL-62-742)

An estimation procedure which is optimum, under certain assumptions, is presented, but this is not, in general, computationally feasible. Two nonoptimum procedures which are simple and practicable are presented, however, one based on a power measurement method and the other on an average magnitude approach; both are shown to yield good results, the latter being somewhat superior. When signal-strength correlation is appreciable over as few as ten digits, overall system performance is only slightly less efficient than would be attained with exact knowledge of the channel conditions. Methods of minimizing the undesirable effects of impulsive and burst-type noise are discussed. Author

N63-10684 Illinois U. Antenna Lab., Urbana

ON THE MAPPING BY A CROSS-CORRELATION ANTENNA SYSTEM OF PARTIALLY COHERENT RADIO SOURCES

Robert H. Mac Phie Oct. 1962 33 p 9 refs
(Contract AF 33(657)-8460)
(Tech. Rept. 62)

It is shown that by means of a cross-correlation antenna system, it is possible to measure the mutual coherence function $T(u,v)$ of a distribution of partially coherent radio sources. The two linear antennas of the system are scanned independently to give a two-dimensional output. A Fourier analysis in two dimensions of this output shows it to be a smoothed version of the true mutual coherence function. The special limiting cases of complete mutual coherence and complete mutual incoherence are considered. Author

N63-10687 Brown Engineering Co., Inc., Huntsville, Ala.

RADIO FREQUENCY TRANSMISSION THROUGH A PLASMA GENERATED IN THE NOSE REGION OF A HIGH VELOCITY GROUND-TO-AIR MISSILE

Harry C. Crews, Jr., B. E. Pope, V. L. Reed, and J. E. White, Jr. Aug. 8, 1962 38 p 5 refs
(Tech. Note R-7)

An estimate of absorptive and reflective attenuation is calculated for signal transmission in the 1- to 100-kmc range through the nose (normal shock) region of a proposed seeker-equipped, high-velocity ground-to-air missile. Author

N63-10757 Air Force Cambridge Research Labs. Electronics Research Directorate, Bedford, Mass.

PHASE, ATTENUATION, AND IMPEDANCE CHARACTERISTICS OF COAXIAL TRANSMISSION LINES WITH THIN TUBULAR CONDUCTORS

E. J. Post May 1962 28 p 4 refs
(AFCRL-62-359)

The phase, attenuation, and impedance characteristics of coaxial lines are discussed, stressing the improvements which can be obtained by removing conductor material that is not effective in the main part of the frequency interval for which the line is used. The ensuing attenuation is higher for the low frequencies but lower for the high frequencies, in comparison with the solid conductor line. The corresponding phase (that is, total phase minus the constant delay) is substantially more linear than for solid conductor lines in the frequency interval of interest. The real part of the characteristic impedance is more independent of frequency than for the solid conductor case. The reactive part of the characteristic impedance increases faster for low frequencies, but can be very nearly represented by a pure capacity, thus enabling a more ideal and simple line termination with lumped elements. Author

N63-10762 Martin Co., Orlando, Fla.

RACEP PROTOTYPE EQUIPMENT Final Report

F. E. Allard et al Dec. 1962 102 p 9 refs
(Contract AF 19(604)-8511)
(OR-2495-1; AFCRL-62-767)

This report covers the Basic, Master, and Satellite RACEP (Random Access and Correlation for Extended Performance) units. Included in the report are the technical characteristics and operating controls of each of the units. Laboratory and field test results are also included. Author

N63-10865 Congress. House. Committee on Science and Astronautics

COMMERCIAL COMMUNICATIONS SATELLITES Hearings before the Subcommittee on Applications and Tracking and Data Acquisitions of the Committee on Science and Astronautics, U.S. House of Representatives, Sept. 18, 19, 21, 27, and Oct. 4, 1962

Fred P. Adler et al Washington, GPO, 1962 184 p
(87th Cong. 2nd Sess. Committee Print [No. 16])

CONTENTS:

1. INTERFERENCE FROM COMMUNICATION SATELLITES TO TERRESTRIAL RADIO RELAY STATIONS International Radio Consultative Committee (CCIR) 1962 p 31-40
2. INTERFERENCE PROBLEMS OF CO-CHANNEL COMMUNICATION SATELLITE SYSTEMS S. G. Lutz (Hughes Research Labs.) and D. E. Miller, (Hughes Aircraft) 1962 p 41-49
3. TWELVE ADVANTAGES OF STATIONARY SATELLITE SYSTEM FOR POINT-TO-POINT COMMUNICATION S. G. Lutz (Hughes Research Labs.) 1961 p 50-59
4. FIRST REPORT BY THE INTERNATIONAL TELECOMMUNICATION UNION ON TELECOMMUNICATION AND THE PEACEFUL USES OF OUTER SPACE 1962 p 162-171

N63-10902 Rome Air Development Center. Techniques Lab., Griffiss AFB, N.Y.

SULFUR HEXAFLUORIDE IN HIGH-POWER MICROWAVE SYSTEMS

Vincent Vannicola Nov. 1962 22 p 9 refs
(RADC-TDR-62-443)

This report reviews the available data on the use of sulfur hexafluoride (SF_6) in microwave systems. Inconsistencies in these data are noted. For example, power ratios (breakdown power of SF_6 over that of air at normal pressures with all other parameters constant) are reported from a low of 3 to a high of 40. The mechanisms of these inconsistencies are discussed in terms of geometric configuration, contamination, localized hot spots, localized corona discharge, etc. Author

N63-10958 International Business Machines Corp. Federal Systems Div., Rockville, Md.

NASA PROJECT MERCURY: BERMUDA MONITOR PROGRAMS

NASA. Goddard Space Flight Center, Greenbelt, Md., May 1, 1962 (Rev.) 447 p
(NASA Contract NAS5-1376)
(MC-104) OTS: $23.50 ph, $13.61 mf

This report on the Bermuda monitor programs in conjunction with the Mercury Project covers the following: basic monitor control programs, data communications channel (DCC) input control, control during processing, DCC output control, control of channels, loading the system, and monitor symbol reference lists. J.R.C.

N63-10959 International Business Machines Corp. Federal Systems Div., Rockville, Md.
NASA PROJECT MERCURY: BERMUDA PROCESSOR PROGRAMS
NASA. Goddard Space Flight Center, Greenbelt, Md., May 1, 1962 (Rev.) 240 p
(NASA Contract NAS5-1376)
(MC-106) OTS: $15.50 ph, $7.40 mf

The major processors used in the Bermuda Control Center are presented as follows: input (high-speed range, azimuth, and elevation radar data); edit (radar data); smoothing (edited data); short arc (computes the orbit of the capsule in form of inertial position/velocity vectors); output (computes required quantities for input to the output display); output (drives Bermuda displays and provides data for Goddard Computing and Communications Center). R.C.M.

N63-10980 Joint Publications Research Service, Washington, D.C.
COSMIC BIOTELEMETRY
N. Agadzhanyan and I. Akulinichev Dec. 10, 1962 12 p Transl. from Tekhn. Molodezhi (Moscow), no. 9, 1962 p 25-26
(JPRS-16600) OTS: $1.60

The biotelemetric system employed in the Vostok-3 and -4 flights is discussed. The multichannel system handled data from the following biosensors: electroencephalogram, electrooculogram, electrocardiogram, pneumogram, and skin resistance. The function of these sensors is discussed, and sample recordings are given of the pulse and respiratory frequency during the first 50 hours of these flights. R.C.M.

09 ELECTRONICS

Includes: circuits and circuit theory; electronic components (e.g., tunnel diodes, transistors, and tubes); and feedback and control theory.

For related information see: 06 Auxiliary Systems; 08 Communications; 15 Instrumentation; 22 Navigation and Guidance; and 25 Physics, Solid-State.

N63-10592 Illinois U. Electrical Engineering Research Lab., Urbana
RESEARCH STUDIES ON PROBLEMS RELATED TO ANTENNAS Quarterly Progress Report No. 4, 1 June 1962 to 31 Aug. 1962
George A. Deschamps and Paul E. Mayes Wright-Patterson AFB, Ohio, Aeronautical Systems Div., Oct. 1, 1962 35 p 8 refs
(Contract AF 33(657)-8460)

This report on antennas covers the following: radiation from periodic structures, the backfire helical antenna, log-periodic magnetic-current antennas, log-spiral antennas, simple array of conical spiral antennas, log-periodic zigzag antennas, an integrated antenna amplifier, collecting systems containing nonlinear and/or active elements, wave propagation along helical conductors, investigation of tapered period corrugated beam, transmission between antennas when the far field approximation does not apply, radiation lens illuminated from a Goubau beam-waveguide, and zone phase plates. J.R.C.

N63-10675 Polytechnic Inst. of Brooklyn. Microwave Research Inst., N.Y.
THE ANALYSIS AND SYNTHESIS OF RC SYNCHRONOUS NETWORKS
Bernard M. Tobin June 5, 1962 178 p 26 refs
(Contract AF 18(603)-105)
(AFOSR-2770; PIBMRI-1016-62)

This report presents a unified theory of analysis and synthesis of RC synchronous networks. The theory leading to a rigorous procedure for synthesizing an RC synchronous network which realizes a prescribed envelope voltage transfer function is developed. A description is given of a general method for the analysis of any RC network containing a plurality of periodically switched, piecewise constant elements. Author

N63-10773 European Atomic Energy Community, Brussels (Belgium)
POWER SUPPLY FOR ESONE STANDARD PLUG-IN SYSTEM
I. De Lotto, G. Giannelli, and L. Stanchi Joint Nuclear Research Center, Ispra Establishment (Italy), Engineering Dept.—Electronics Service, Oct. 1962 26 p 5 refs
(EUR-30.e) Available from Belgian-American Bank and Trust Co., N.Y., account No. 121.86: 30 Belg. Fr.

A transistor power supply for two cases is described. It consists of a 24 V semiregulated voltage from which all the regulated voltages required by the standard are derived. The 24 V semiregulated voltage is obtained by controlling two switching transistors with magnetic amplifiers. The regulators use a new circuit and are protected against overloads and short-circuits. The analysis of the circuits and the protection system are given. Author

N63-10928 Battelle Memorial Inst., Columbus, Ohio
THE EFFECTS OF SPACE RADIATION ON ELECTRONIC COMPONENTS
Donald J. Hamman *In* Soc. of Aerospace Mater. and Process Engr. National Symp. on Effects of Space Environment on Materials, St. Louis, May 7, 8, and 9, 1962 11 p 27 refs
(See N63-10912 02-01)

There is little information available describing the effects of space radiation, as such, on electronic components. Semiconductors have been studied under simulated space radiation environment, i.e., proton and electron bombardment. Effects on other types of electronic components are estimated by comparison. Author

10 FACILITIES

Includes: airports; lunar and planetary bases; ground support systems; related logistics; simulators; test facilities (e.g., rocket engine test stands and wind tunnels); test ranges; and tracking stations.

For related information see: 06 Auxiliary Systems.

N63-10794 National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
DESCRIPTION AND PRELIMINARY CALIBRATION TESTS OF A SMALL ARC-HEATED HYPERSONIC WIND TUNNEL
William B. Boatwright, Roger B. Stewart, and John E. Grimaud Washington, NASA, Dec. 1962 36 p 15 refs
(NASA-TN-D-1377) OTS: $1.00

A description, modification history, and results of preliminary calibration tests in a small hypersonic arc-heated wind tunnel are

presented. Results obtained with different arc-heater configurations are described, and it is shown that the use of a 12,000-gauss magnetic field to rotate the arc offers distinct advantages over an arc-heater configuration with a 4,000-gauss magnetic field. Comparisons of the different configurations are made with regard to performance, steadiness, electrode erosion, and contamination. Results of pitot-pressure surveys in the 5° half-angle conical nozzle and the cylindrical test section of this tunnel at a stagnation pressure of 12 atmospheres and a stagnation temperature of 3,600° K are presented. Measurements of the total heat transferred to a section of the tunnel which included the throat are compared with theoretical predictions. Author

11 FLUID MECHANICS

Includes: boundary-layer flow; compressible flow; gas dynamics; hydrodynamics; and turbulence.

For related information see: 02 Aerodynamics of Bodies, Combinations, and Internal Flow, 03 Aerodynamics of Wings and Control Surfaces; 13 Heat Transfer; and 24 Physics, Plasma.

N63-10590 AeroChem Research Labs., Inc., Princeton, N. J.
FUNDAMENTAL SOLUTION TO THE DIFFUSION BOUNDARY LAYER EQUATION FOR NEARLY SEPARATED FLOW OVER SOLID SURFACES AT VERY LARGE PRANDTL NUMBERS
Daniel E. Rosner Nov. 1962 27 p 19 refs Prepared for journal publication
(Contract AF 49(638)-1138)
(TP-52)

Using the method of self-similar solutions, an exact fundamental solution to the equation of convective diffusion is obtained for the case of nearly separated flow over a surface when the Prandtl number is very large compared to unity. The driving force for diffusion is assumed to change abruptly from zero to unity at the streamwise location $x = \epsilon$, and an arbitrary distribution of the velocity profile curvature parameter $(\partial^2 u/\partial y^2)\, y = 0$ is allowed through the use of the Von Mises transformation. An integral (profile) method using a cubic polynomial for the dimensionless concentration (temperature) profile is shown to predict the correct functional form of transfer coefficient but overestimates its magnitude by 3.3 percent. This is more than twice the error of a corresponding integral method solution to the nonseparating flow problem, suggesting once again that, for a given number of terms in the approximating polynomial, the accuracy of profile methods in general deteriorates as one nears separation of the velocity boundary layer. The exact solution is specialized to the case of separated laminar wedge flow, and transfer coefficients are derived for both step-change and power-law driving force distributions. These results have been used to compare the effect of pressure gradient (wedge variable) on the sensitivity of local transfer coefficients to streamwise gradients in driving force. In the limit, results for the step change in driving force are shown to reduce to the proper isothermal coefficient at very large Prandtl numbers. Author

N63-10597 David Taylor Model Basin. Hydromechanics Lab., Washington, D. C.
THRUST DEDUCTION DUE TO A PROPELLER BEHIND A HYDROFOIL
John L. Beveridge Oct. 1962 43 p 14 refs
(Rept. 1603)

A method which is based on Lagally's theorem is presented for computing the resistance augmentation, or thrust deduction, for submerged hydrofoil-propeller arrangements. The effect on the magnitude of thrust deduction of foil lift, propeller load, foil span, foil flap angle, and propeller-foil spacing was investigated. Computed examples and experimental thrust-deduction results for several hypothetical arrangements showed good agreement. Author

N63-10611 Naval Weapons Lab., Dahlgren, Va.
MOTION OF A PAIR OF VORTICES BEHIND A CYLINDER
Gerwig Vibrans Nov. 5, 1962 55 p 12 refs
(NWL-1794)

The ideal flow pattern of a vortex pair, while traveling in equilibrium with a cylinder, and the forces on the cylinder are calculated for a number of examples, which include the general case of unsymmetric configurations. The motion of the vortices is investigated in the case where they are slightly displaced from the equilibrium position. An increase of flow velocity induces an oscillatory movement, and an oscillating force acts on the cylinder. If a programed acceleration leads to a new stationary flow, then the net effect of the vortices is to diminish the induced mass. Even when the vortex strength is assumed to increase, there is apparently a decrease in induced mass. Author

N63-10612 National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
NOTE ON THE THREE-POINT BOUNDARY-VALUE PROBLEM FOR THE BLASIUS EQUATION
E. Dale Martin N.Y., Inst. of the Aerospace Sciences Repr. from J. Aerospace Sci., v. 29, no. 9, Sept. 1962 p 1133-1134 12 refs
Previously issued as NASA publication; for abstract see N62-12460 07-11

A method is presented that makes possible the direct calculation of the boundary conditions of the three-point boundary-value problem encountered in the theory of laminar mixing. The evaluation of the function $f(\eta)$ and its derivatives is accomplished by a single integration of the Blasius equation, without iteration. Results are obtained immediately to any desired accuracy. J.R.C.

N63-10619 California U., Berkeley. Inst. of Engineering Research
DIFFUSIVE SEPARATION OF A GAS MIXTURE APPROACHING A SAMPLING PROBE
Bruce S. Masson (M. S. Thesis) Oct. 31, 1962 63 p 18 refs
(Contract Nonr-222(45))
(IER Ser. 20, Issue 141; HE-150-206)

The effect of inserting a probe into a flow field of a flowing gas mixture to obtain localized concentration measurements is considered. The diffusion mechanisms, due to the baro-diffusion and the thermal diffusion effects that cause the concentration variations in the original flow field, cause further changes in the mixture composition during the sampling process. Author

N63-10620 Federal Aviation Agency. Systems Research and Development Service, Washington, D.C.
FOG CHAMBER LIGHTING TESTS [Interim] Memorandum Report
L. C. Vipond Nov. 1962 17 p
(Contract ARDS-434)

A fog chamber simulating a 4,000-ft. stretch of runway is developed to aid in the study of airport runway lighting. Using the fog chamber, charts and tables can be prepared and verified for candlepower versus distance seen under almost any controlled fog condition or atmospheric transmissivity. The fog chamber will permit a realistic study of the effects of backscatter of lights, both high and low candlepower units. Photometric distribution requirements can be studied under different low visibility conditions. J.R.C.

N63-10648 California Inst. of Tech., Pasadena

EFFECTS OF THERMAL CONDUCTION ON SONOLUMINESCENCE

Robert Hickling Nov. 1962 28 p 17 refs
(Contract Nonr-220(28))
(Rept. 85-21)

Current experimental results indicate that sonoluminescence is largely thermal in origin, with the spectra showing a direct relation between luminous intensity and the temperatures generated inside the collapsing cavitation bubbles. The strong dependence of the luminous intensity on the nature of the gas dissolved in the liquid is explained in terms of thermal conduction. Provided the cavitation bubbles are sufficiently small, loss of heat from the bubble into the liquid can significantly reduce the temperatures attained during collapse, so that there is a consequent reduction in the luminous intensity. This process is demonstrated analytically by means of a numerical solution of the equations of motion of a gas inside a collapsing cavitation bubble. The agreement between the theory and the observed luminous intensities for different dissolved gases is good. Author

N63-10671 Aro, Inc., Arnold Air Force Station, Tenn.

FURTHER EXPERIMENTS ON IMPACT-PRESSURE PROBES IN A LOW-DENSITY HYPERVELOCITY FLOW

A. B. Bailey Arnold Engineering Development Center, Nov. 1962 27 p 8 refs
(Contract AF 40(600)-1000)
(AEDC-TDR-62-208)

An experimental investigation of the behavior of flat-faced, impact-pressure probes with a range of orifice-to-probe diameter ratios was made in heated argon under conditions where $M_\infty = 4$ to 14, $T_0 = 2700$ to 4300° K, and $Re_2/in. = 30$ to 430. At the lower Reynolds numbers, the measured impact pressure was found to decrease with the pressure sensing orifice size. As the Reynolds number increased, this orifice effect became less significant, and at the higher Reynolds numbers no decrease in measured impact pressure was noted for the smallest orifice tested. Author

N63-10680 Aerospace Corp. Physical Research Lab., El Segundo, Calif.

THE GOVERNING MACROSCOPIC EQUATIONS OF PARTIALLY IONIZED GASES

D. M. Dix July 25, 1962 45 p 8 refs
(Contract AF 04(695)-69)
(TDR-69(2230-04)TN-2; DCAS-TDR-62-133)

Useful formulations of the macroscopic conservation relations for a three-component mixture composed of ions, electrons, and neutral particles are developed from the basic forms of the equations for the individual species. The development represents primarily an orderly compilation of the work of previous investigators, although the equations developed are somewhat more general than those previously derived. In particular, all inertial and viscous terms are retained, and the temperatures of the individual species are not required to be equal. In addition, treatment of the energy equations is included. Author

N63-10686 Canadian Armament Research and Development Establishment, Valcartier

ON THE DEVELOPMENT OF A METHOD FOR PREDICTING THE GASEOUS RADIATION CHARACTERISTICS OF BLUNT BODIES AT HYPERSONIC SPEEDS PART 1—CHEMICAL KINETICS AND GAS DYNAMICS

D. Ellington (Computing Devices of Canada, Ltd.) and B. K. Winterbon Nov. 1961 33 p 6 refs
(Contract DA-20-018-ORD-23307)
(CARDE-TM 627/61)

A method has been developed for determining the hypersonic flow characteristics around a body of spherical nose shape with arbitrary afterbody, based on a gas model comprising an interacting mixture of Lighthill ideal dissociating gases, including the effects of finite chemical relaxation times. Six chemical reactions have been considered, including the predominant ones governing the formation of nitric oxide, which is largely responsible for the nonequilibrium overshoot in gaseous radiation intensity. The shock-cap flow solution is based on Freeman's method, and the inviscid flow around the afterbody and viscous wake is determined by the method of characteristics in axisymmetric flow for a chemically reacting mixture of gases. Author

N63-10710 Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena

FLOW SEPARATION IN A CONTOUR NOZZLE

E. J. Roschke and P. F. Massier Repr. from ARS Journal, Oct. 1962 p 1612-1613 4 refs
(NASA Contract NAS7-100)
(JPL-TR-32-317)

Static pressure measurements have been made to determine the flow separation in a contour nozzle. The nozzle was designed by the method of characteristics for constant $\gamma = 1.22$ to have a uniform and parallel exit flow at an area ratio of approximately 55:1 with an exit Mach number of 4.6. The throat diameter was 0.552 in. and the expansion-area ratio was $\epsilon = 20.3$. The data obtained for the separation-area ratio indicated that flow separation tended to occur at smaller area ratios in the contour nozzle than would have been the case in a conical nozzle. R.C.M.

N63-10729 Brown Engineering Co., Inc., Huntsville, Ala.

THE DEVELOPMENT AND ANALYSIS OF THREE INDEPENDENT VARIABLE COMPRESSIBLE FLOW THEORY

Vernon L. Reed Sept. 20, 1962 62 p 6 refs
(Tech. Note R-11)

The theory of compressible, inviscid fluid flow was developed in order to establish a basis to evaluate flow fields. The hyperbolic, second order, nonlinear, partial differential characteristics of the gas dynamic equations were solved using a coordinate transformation to a characteristic surface and a numerical finite difference technique. Author

N63-10739 France. Office National d'Études et de Recherches Aéronautiques, Chatillon-sous-Bagneux

CONDITIONS DE CHOC ET STRUCTURE DES ONDES DE CHOC DANS UN ÉCOULEMENT STATIONNAIRE DE FLUIDE DISSIPATIF [SHOCK CONDITIONS AND STRUCTURE OF SHOCK-WAVES IN A STEADY FLOW OF DISSIPATIVE FLUID]

Paul Germain and Jean-Pierre Guiraud 1962 46 p 9 refs In French; English summary
(ONERA-105)

This work differs from conventional studies on the same subject in that the thickness and camber terms, usually neglected, are here taken into account. More precisely, calling ϵ the reciprocal of the Reynolds number based on the shock-wave curvature radius, the ϵ terms of the first order are systematically taken into account. The most important result is a system of formulas giving a correction of order ϵ for the various Rankine-Hugoniot conditions. The suggested formulas may, for instance, have to be used instead of the conventional ones to evaluate the loss of the total pressure across the detached shock-wave which is found at the nose of a very small probe in supersonic flow. Author

N63-10751 Technical Research Group, Syosset, N.Y.

A COMPARISON OF EXPERIMENTAL DATA WITH SIMPLE THEORETICAL RESULTS FOR VENTILATED FLOW

Peter Thomsen Aug. 20, 1962 53 p 7 refs
(TRG-156-SR-1)

The results obtained by applying the 2-dimensional cavity theory are compared with those of experiments, as to length and drag, conducted with the ventilated cavity. With the layered 2-dimensional model for ventilated flow, theoretical cavity lengths were obtained

with are unreasonably larger than experimental lengths. The theoretical cavity drag values obtained were in substantial agreement with the experimental drag values. In order to obtain a correction due to the free surface, a 3-dimensional dipole-generated flow around the strut in the absence of a cavity was considered. An image system is formed so that the total flow satisfies the infinite-speed free-surface condition. Upon applying this correction for the free surface effect, it was found that the theoretical drag coefficient is essentially unchanged and that the theoretical cavity length is changed appreciably in the near surface region. J.R.C.

N63-10758 Avco-Everett Research Lab., Everett, Mass.
THE MAGNETOHYDRODYNAMICALLY SUPPORTED HYPERSONIC SHOCK LAYER
R. H. Levy and H. E. Petschek Sept. 1962 46 p 16 refs
(Contract AF 04(694)-33)
(Avco-Everett Res. Rept.-140; BSD-TDR-62-337)

The two-dimensional problem of the interaction of a hypersonic flow with the field of a current-carrying wire is analyzed. The electrical conductivity behind the normal shock is taken to have an arbitrary finite value, while the free-stream conductivity is zero. It is found that the magnetohydrodynamically supported shock wave follows the magnetic field lines closely and that the hot flow is confined to a narrow region behind the shock at all values of conductivity. Author

N63-10786 Electro-Optical Systems, Inc., Pasadena, Calif.
A PROBLEM IN TURBULENT REACTING GAS DYNAMICS Research Report
Saul Feldman Mar. 1962 38 p 15 refs
(Contract DA-04-495-ORD-3245; ARPA Order 203-61)
(EOS-RR-5)

The case of a streamtube of cold gas going through a strong normal shock wave is treated. Chemical reaction is allowed to occur downstream of the shock, where the pressure and the distribution of certain turbulent correlation functions are prescribed as a function of distance. It is shown that the turbulence modifies the flow field mainly through the effects it has on the reaction rates leading to a hotter gas than if just the mean values of the thermodynamic functions for the turbulent flow were considered. The Gibbs' function for the fluid is also modified by the turbulent fluctuations, leading to different final equilibrium conditions. Author

N63-10788 General Electric Co. Space Sciences Lab., Philadelphia, Pa.
GAS DYNAMICS OF HOMOGENEOUS ATOM RECOMBINATION IN A CYLINDRICAL TUBE
Terence C. Flaherty, John F. Wilson, and Sinclaire M. Scala Dec. 1962 34 p 7 refs
(Contracts AF 04(647)-269 and AF 04(694)-222)
(R62SD97)

The temperature decay in a cylindrical vessel containing a chemically reacting gas is analyzed by utilizing the energy equation which is coupled with the chemical kinetic equation of the dissociated gas. It is shown how the net rate of temperature decay is dependent on the simultaneous effects of energy release of the recombining atoms and the heat conducted from the gas into the tube wall. This yields a method of obtaining the recombination rate coefficient from experimental temperature measurements. Author

N63-10878 Purdue U. School of Aeronautical and Engineering Sciences, Lafayette, Ind.
SIMILARITY PARAMETERS IN RADIATION GAS-DYNAMICS
R. Goulard [1962] 53 p 75 refs Presented at the International Symposium on "High Temperatures in Aeronautics", Politecnico di Torino (Italy), Sept. 10-12, 1962
(NSF Grant G-23170, PRF 3127)
(A&ES-62-8)

The similarity parameters due to the presence of radiation fluxes in gas dynamics are presented in two distinct groups. The "intrinsic" parameters include those which govern the expression of the radiation flux itself. The "extrinsic" parameters are those which establish the importance of radiation transfer in relation with the other transfer effects. The one-dimensional formulation of the flux is presented with an extension of Kourganoff's Λ operator to finite configurations. Several pseudo one-dimensional flow models are briefly described. Author

N63-10884 Stanford Research Inst., Menlo Park, Calif.
THE DRAG OF CYLINDERS IN STEADY PARTICLE-LADEN GAS FLOW Final Report (for Phase III)
H. W. Kriebel and E. G. Chilton Sept. 1962 103 p 19 refs
(Contract DA-49-146-XZ-024)
(DASA-1322)

Two methods have been proposed to correlate data on drag of dusty airflow. Method I is based on perfect gas behavior, assuming the dust to contribute only to the gas density. Method II assumes that the particles and gas follow different paths in the vicinity of the body, and the drag due to the gas and that due to the particles are computed independently. Data are correlated by an inertia parameter, $\bar{K}$, which combines particle and object diameters, gas velocity, gas density, gas viscosity, and particle density into a nondimensional number. For values of $\bar{K}$ less than 1, Method I gives a fairly reliable drag prediction. Method II should be used if $\bar{K}$ is greater than 1. Author

N63-10885 Stanford Research Inst., Menlo Park, Calif.
DRAG OF OBJECTS IN PARTICLE-LADEN AIR FLOW. PHASE IV: BLUNT BODIES AND COMPRESSIBILITY EFFECTS Final Report
R. E. Lundberg Nov. 1962 59 p 12 refs
(Contract DA-49-146-XZ-024)
(DASA-1326)

As a part of a continuing theoretical and laboratory study of the drag forces on variously shaped objects in dusty airflow due to a nuclear explosion, results reported for drag effects on cylinders and spheres are compared with drag effects on rectangular blunt bodies. In the region where air flow can be considered incompressible (say in the 20 psi overpressure region and below) the inclusion of one pound of dust in each pound of air will increase the drag on typical targets by a factor ranging between 1.5 and 4. In the region where compressibility must be considered (say above 20 psi overpressure) the effect of dust is more difficult to determine, but it is probable that the drag increase is even larger than in the low overpressure region. Author

N63-10935 Aberdeen Proving Ground. Ballistic Research Labs., Md.
A STUDY OF SHOCK WAVE ATTENUATION IN TUNNELS
Robert O. Clark May 1962 42 p 3 refs
(Supported in part by DASA under WEB-13.111)
(BRL-Memo-1401)

A theoretical investigation of shock-wave expansion and viscous attenuation in a tunnel is described. In particular, relationships between the applied and transmitted shock pressure are presented for various entrance configurations and orientations. Shock-tube data are given to verify the theory. Working equations and graphs are given to aid in the solution of other shock-wave-tunnel problems, assuming a classical waveform for the shock wave and a constant tunnel cross section. Author

N63-10936 General Electric Co. Missile and Space Vehicle Dept., Philadelphia, Pa.
TURBULENT BOUNDARY-LAYER CORRECTION AT HIGH REYNOLDS NUMBERS
George K. Walker Nov. 2, 1962 12 p 5 refs
(TFM-8151-006)

The method of calculating turbulent heat-transfer rates used in current design programs is not valid for Reynolds numbers greater than about 10^7. On blunt bodies, the Reynolds number rarely exceeds this limitation; however, on relatively sharp configurations the Reynolds numbers tend to be extremely high. Therefore, an engineering-type correction has been derived. The development is based on an approximation to a skin-friction equation which is known to be valid over a wide range of Reynolds numbers. Author

N63-10998 Hydronautics, Inc., Laurel, Md.
CAVITATION DAMAGE IN LIQUID METALS Report of Progress for the Period 2 Aug. - 2 Oct. 1962
[Phillip Eisenberg] [1962] 21 p 3 refs
(NASA Contract NASr-105)
(Progress Rept. 235-2) OTS: $2.60 ph, $0.83 mf

The specialized laboratory equipment for the study of cavitation damage in liquid metals has been designed, fabricated, and partially installed. The apparatus consists of a magneto-striction device which uses a vibrating nickel transducer stack attached to a tuned stainless steel exponential horn to obtain steady state maximum amplitude. A test button is firmly attached to the bottom of the horn and vibrates in the liquid at about 15,000 cycles per second at an amplitude of 0.002 inch. This rapid pulsation causes cavities to form in the liquid and alternately collapse on the specimen surface to produce the cavitation damage. Special modifications of this apparatus for use with liquid metals, particularly liquid sodium, include higher power, special cooling, atmosphere control, heating and pressure controls, and safety devices. M.P.G.

12 GEOPHYSICS

Includes: auroral phenomena; upper atmospheric studies; cartography; geodesy; and geomagnetism.

For Van Allen belts see: 28 Space Radiation.

For related information see: 05 Astronomy and Astrophysics; 21 Meteorology; and 29 Space Sciences.

N63-10608 National Aeronautics and Space Administration. Goddard Inst. for Space Studies, New York, N.Y.
A METHOD FOR DETERMINING ATMOSPHERIC DENSITY FOR SHORT ARCS OF AN ALMOST CIRCULAR SATELLITE ORBIT
Myron Lecar and Richard Morrison Repr. from J. Astronaut. Sci., v. IX, no. III, 1962 p 82-85 8 refs

A method is described for determining atmospheric density localized to a small range in height and geographic location, using satellites such as the Mercury capsule. Such satellites permit determining orbital elements accurately at several points along a single revolution of the satellite. By observing the rate at which the satellite loses energy to the atmosphere between two such points, the atmospheric density can be inferred. If the tracking data are sufficiently precise, the change in density with height can be determined as the satellite moves along its orbit, and possibly also the variation in scale height as the satellite moves from the sunlit to the dark side of the earth. The method used here is particularly applicable for cases when only a fraction of a revolution is used. Within a single revolution, the orbital elements show period variations caused by the noncentral portion of the earth. These variations tend to mask the effect of the drag. The method avoids this problem by working with the total energy which suffers no perturbations apart from the effect of the drag itself. A first approximation of the energy less due to drag assumes a circular orbit; the eccentricity is found to be negligible; corrections for the rotation of the atmosphere and for the change in height above an oblate earth are applied; and the method is applied to a numerically integrated orbit of the Mercury capsule. M.P.G.

N63-10609 Pennsylvania State U. Coll. of Mineral Industries, University Park
A COMPARISON OF DATA ACCURACY IN THE TROPOSPHERE AND IN THE STRATOSPHERE Scientific Report No. 2
John Bruce Hovermale Sept. 1962 49 p 2 refs
(Contract AF 19(604)-7261)
(AFCRL-62-1013)

Estimates of the standard errors of observed and time-extrapolated data are made for the standard pressure levels from 700 mb through 25 mb. Error estimates are used to establish the relative importance of height and wind data in synoptic analysis, and the relative importance of persistence data compared to observed values. Author

N63-10617 Centro Radioelettrico Sperimentale G. Marconi, Rome (Italy)
SPORADIC-E IONIZATION OBSERVED BY THE BACKSCATTER TECHNIQUE Technical Note No. 9
P. Dominici Feb. 15, 1962 17 p 4 refs
(Contract AF 61(052)-139)
(AFCRL-62-395)

The examination of the results of the ionospheric sounding by ground backscatter, as to the occurrence of the propagation via sporadic-E ionization, is presented. The seasonal and diurnal occurrence, as well as the azimuthal distribution of the *Es* echoes, are discussed. Author

N63-10685 Iowa State U., Iowa City
STUDY OF ENERGETIC ELECTRONS AND THEIR RELATIONSHIP TO AURORAL ABSORPTION OF RADIO WAVES
B. Maehlum and B. J. O'Brien [1962] 52 p 32 refs Prepared for journal publication
(NASA Grant NsG-233-62; Contract N9onr-93803)
(SUI-62-23-B) OTS: $5.60 ph, $1.76 mf

The high-latitude boundary (LN) of energetic electrons ($E \geq 40$ kev) which are quasi-trapped at an altitude of 1000 kilometers was studied with the satellite Injun I over North America during periods of magnetic quiet and magnetic storms in 1961. The boundary was very sharp during disturbed periods, and it moved further from the pole during larger disturbances. The electron intensity south of LN was enhanced during magnetic disturbances, and the electron spectrum was much softer than normal just at the boundary. Throughout two magnetic storms in October and December 1961, the boundary (LN) of the energetic electron flux and the boundary of the auroral absorption of radio waves were coincident. Quantitative correlation of the intensities of the two phenomena is discussed. Author

N63-10688 Auckland U. Seagrove Radio Research Station (N. Zealand)
LARGE-SCALE IRREGULARITIES IN THE IONOSPHERE
J. E. Titheridge [1962] 29 p 19 refs Prepared for journal publication
(NASA Grant NsG-54-60)
OTS: $2.60 ph, $1.07 mf

The amplitude of the 20 Mc/s signal from the satellite Explorer 7 was recorded at Auckland from November 1960 to August 1961. Variations in the fading period are used to study the irregularities which occur in the electron density of the ionosphere. Relations are given for calculating the size and density of these irregularities directly from plots of the fading period of the received signal. Results form 770 irregularities are presented. Author

N63-10768 International Geophysical Year World Data Center A: Airglow and Ionosphere, Central Radio Propagation Lab., Boulder, Colo.
TENTH 6-MONTHLY CATALOGUE OF DATA. DATA RECEIVED BY WDC-A DURING THE PERIOD 1 JULY 1957-JUNE 1962
[1962] 31 p

Data on airglow and the ionosphere are presented in tabular form. The airglow data are from photometric observations at wavelengths between 5260Å and 6300Å. Observations of the ionosphere include the following: vertical incidence soundings, electron density, absorption, drift, atmospheric radio noise, whistlers, and backscatter. R.C.M.

N63-10789 Council of Scientific and Industrial Research. Radio Research Committee, New Delhi (India)
IONOSPHERIC DATA [FOR MARCH 1962]
1962 59 p
(RRC-A82)

Regular ionospheric observations are being taken in India in a chain of eight stations, seven of which are in the 75° E longitude zone, covering a range of geomagnetic latitudes from 19.2° N to 0.9° S. This document is a coordinated publication of the ionospheric data of all these stations, with data on actual propagation conditions, and such geophysical data as are of interest for ionospheric studies. Author

N63-10897 California Inst. of Tech., Pasadena
A CORRECTION TO THE APPROXIMATE CONDITION FOR LOCATING THE BOUNDARY BETWEEN A MAGNETIC FIELD AND A PLASMA
Leverett Davis, Jr., and David B. Beard (NASA. Goddard Space Flight Center) Repr. from J. Geophys. Research, v. 67, no. 11, Oct. 1962 p 4505-4507
(NASA Grant NsG-151-61)

The correct approximate equation is given for locating the boundary between a magnetic field and a plasma. The precise boundary conditions for the interface between a magnetic field and a perfectly conducting plasma are expressed in terms of the plasma pressure and the magnetic fields on the two sides of the interface. The problem is reduced to one of determining the interface by the solution of a first order, nonlinear, partial equation. J.R.C.

N63-10911 Council of Scientific and Industrial Research. Radio Research Committee, New Delhi (India)
IONOSPHERIC PREDICTIONS FOR JANUARY AND FEBRUARY 1963
Sept. 1962 8 p In 2 vols.
(RRC-B76; RRC-B77)

East Zone predicted median values for the ordinary ray critical frequencies and maximum usable frequencies for 4000 km for January and February 1963 are given. P.F.E.

N63-10937 Pennsylvania State U. Ionospheric Research Lab., University Park
MULTISLAB CONCEPT APPLIED TO RADIO-WAVE PROPAGATION IN THE IONOSPHERE AND ITS LIMIT TO THE CONTINUOUS IONOSPHERE Scientific Report No. 176
A. J. Ferraro Jan. 1, 1963 22 p 8 refs
(Contract AF 19(604)-8012)
(AFCRL-62-1079)

This report describes the multislab approach to radio-wave propagation at vertical incidence in the ionosphere, and considers the limiting case of an infinity of slabs, i.e., the transition to the continuous ionosphere, including magneto-ionic coupling. It is shown that the multislab solution does converge. In the process of demonstrating convergence, four first-order coupled equations are generated. A discussion of limiting polarization with the use of the first-order equations is given, and the results are compared with those obtained from the Rydbeck second-order coupled propogation equations. Author

N63-10938 Pennsylvania State U. Ionosphere Research Lab., University Park
ANALYSIS OF LOW FREQUENCY IONOGRAMS FROM STEEP GRADIENT PROFILES Scientific Report No. 174
A. J. Ferraro and C. P. Tou Dec. 1, 1962 43 p 14 refs
(Contract AF 19(604)-8012)
(AFCRL-62-1063)

In a previous report the phenomenon of interference fringes on swept low-frequency polarization records has been interpreted as formed from two overlapping echoes. In the present report, the interference fringes are interpreted as formed from the waves of two different modes reflected by a high-gradient sporadic layer in the E-region. This interpretation has shown satisfactory agreement with the experimental data. Author

N63-10974 Joint Publications Research Service, Washington, D.C.
CONFERENCE ON THE SIBERIAN TOPOGRAPHERS [FIRST, NOVOSIBIRSK, NOVEMBER 14-19, 1962]
D. A. Fialkov Dec. 17, 1962 9 p Transl. of Geol. i Geofiz., Akad. Nauk SSSR, Sibirsk. Otd. (Novosibirsk), no. 8, 1962 p 133-134
(JPRS-16729) OTS: $1.10

This paper describes the First Conference of the Topographers of the Geological Service of Siberia and the Far East. The material covered in the lectures is listed and the activities of the organizations represented are discussed. R.C.M.

N63-10988 National Aeronautics and Space Administration, Washington, D.C.
SPECTRAL, ELECTROPHOTOMETRICAL, AND RADAR RESEARCHES OF AURORAE AND AIRGLOW
V. I. Krasovskiy, ed. Dec. 1962 78 p 6 refs Transl. of "Spektral'nyye, elektrofotometricheskiye i radiolokatsionnyye issledovaniya polyarnykh siyaniy i svecheniya nochnogo neba" IGY Program, Section IV, No. 5, Academy of Sciences, USSR (Moscow) 1961
(NASA-TT-F-106) OTS: $2.00

The contents, fourteen articles, were presented at a special seminar of the Section on the Physics of the Upper Atmosphere of the Atmospheric Physics Institute of the Academy of Sciences, USSR, held on April 25-27, 1960. Author

13 HEAT TRANSFER

Includes: ablation; cooling; heating; and other thermal effects.

For aerothermodynamics see: 02 Aerodynamics of Bodies, Combinations, and Internal Flow; and 03 Aerodynamics of Wings and Control Surfaces.

For combustion see: 26 Propellants and Combustion.

For related information see: 11 Fluid Mechanics.

N63-10708 Ames Lab., Iowa State U. of Science and Tech.
THERMAL DIFFUSIVITY MEASUREMENTS ON A FINITE DISK
Paul Dean Maycock (M.S. Thesis) and G. C. Danielson Wash., D.C. AEC Div. of Tech. Information, June 1962 38 p 14 refs
(Contract W-7405-eng-82)
(IS-492) OTS: $1.00

A new technique has been developed for measuring the thermal diffusivity of finite disk-shaped samples. The radial heat-flow equation was solved by the method of finite differences. A FORTRAN program which calculates the diffusivity from the experimental data was developed, and an IBM 704 computer was used to process the data. Data on Armco iron show that the method is capable of giving correct values for thermal diffusivity. Author

N63-10733 National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio

HEAT TRANSFER TO A SPHERE WITH A RETROROCKET EXHAUSTING INTO A FREE STREAM; MACH 2.0 AND 0.8

Robert A. Wasko Washington, NASA, Nov. 1962 20 p 3 refs (NASA TN-D-1535) OTS: $0.50

A sphere with a flush-mounted lox - JP-4 retrorocket was tested in the Lewis 8- by 6-foot tunnel at freestream Mach numbers of 2.0 and 0.8 for a range of angle of attack, combustion-chamber pressure, and oxidant-fuel ratio. Effects of test variables on the spherical surface heat flux, heat-transfer coefficients, recovery temperatures, and static pressures are presented. Author

N63-10791 Solar, San Diego, Calif.

DEVELOPMENT OF MANUFACTURING METHODS FOR LIGHTWEIGHT METAL FOIL HEAT EXCHANGERS Quarterly Report No. 1 [June 18-Sept. 17, 1962]

L. A. Schlagel and Merrill P. Rope Oct. 1, 1962 76 p 5 refs (Contract AF 33(567)-8766)

Significant improvements were made to the design of the heat exchanger. A plastic mockup was completed which showed the principle of operation of the new design. Experimental dies were constructed. These dies were used to form experimental pieces. Experimental joining methods were tried using the formed stainless steel parts. Both resistance welding and brazing were used. A high-pressure test installation was assembled. Author

N63-10798 National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

A FREE-FLIGHT INVESTIGATION OF ABLATION OF A BLUNT BODY TO A MACH NUMBER OF 13.1

Clyde W. Winters, William G. Witte, Bernard Rashis, and Russell N. Hopko Washington, NASA, Dec. 1962 23 p 11 refs (NASA-TN-D-1500) OTS: $0.75

A five-stage rocket-propelled research-vehicle system was flown to a maximum Mach number of 13.1 at an altitude of approximately 78,000 feet to determine ablation characteristics of Teflon in free flight. Continuous in-flight measurements were made using sensors developed by the National Aeronautics and Space Administration. The sensors were located on the blunted face of a nose cone constructed from Teflon, with one at the stagnation point and two others at a surface distance of 0.62 radius on opposite sides of the stagnation point. The ablated-length measurements were in close agreement with analytical predictions. The analytical predictions, upon inclusion of the pertinent material property values, should be applicable to other materials as well as Teflon. Author

N63-10913 Douglas Aircraft Co., Inc., Santa Monica, Calif.

MATERIALS THERMAL PROPERTIES AND ENVIRONMENTAL THERMAL SIMULATION SUPPORTING FACILITIES FOR MISSILES AND SPACE VEHICLES

A. C. Rawuka *In* Soc. of Aerospace Mater. and Process Engr. National Symp. on Effects of Space Environment on Materials, St. Louis, May 7, 8, and 9, 1962 p 1-18 12 refs (See N63-10912 02-01)

To provide the necessary materials thermal-properties and environmental thermal-simulation supporting data, extensive facilities with suitable scientific personnel are required. Material thermal-property characteristic measurements vary, such as: determining the thermal conductivity of foam insulations immersed in liquid hydrogen; testing ablative materials in hyperthermal environment; measuring thermal absorptivity and emissivity, thermal conductivity, and other properties of refractory materials up to 6000° F. Author

N63-10916 Aeronautical Systems Div., Air Force Systems Command, Wright-Patterson AFB, Ohio

IMPROVED COATINGS FOR TEMPERATURE CONTROL IN A SPACE ENVIRONMENT

Harold H. Hormann, James H. Weaver, and James J. Mattice *In* Soc. of Aerospace Mater. and Process Engr. National Symp. on Effects of Space Environment on Materials, St. Louis, May 7, 8, and 9, 1962 57 p 18 refs (See N63-10912 02-01)

This paper presents the results of recent Air Force in-house research directed toward the preparation of stable temperature-control coatings which will be used to maintain overall vehicle and component temperature balance in the space environment. The usefulness and limitations of organic and anodic coatings are stressed. The applicability of these materials is discussed, with emphasis on proper formulation and application techniques and on vacuum, thermal, and ultraviolet radiation resistance, all of which are found to be important factors in preparing required coatings for use on space vehicles. Author

N63-10917 Armour Research Foundation, Chicago, Ill.

HIGHLY REFLECTING COATINGS FOR THE SPACE ENVIRONMENT

C. D. Miller, H. L. Rechter, and E. H. Tompkins *In* Soc. of Aerospace Mater. and Process Engr. National Symp. on Effects of Space Environment on Materials, St. Louis, May 7, 8, and 9, 1962 21 p 7 refs (See N63-10912 02-01)

(Sponsored by JPL)

OTS: $2.60 ph, $0.83 mf

In order to test the stability of white coatings in the space environment, a solar simulator with several unique features, including automatic in situ recording of changes in a/e ratios for as many as twelve samples simultaneously has been designed and built. A wide variety of materials may be tested, from loose powders to films, either unsupported or on a variety of substrates. Samples are irradiated by several A-H-6 lamps, which have been widely accepted as the best available approximation of extraterrestrial sunlight, and vacuum (ca 10^{-6} mm) is maintained by a suitably trapped oil diffusion pump. Results obtained indicate that all synthetic oxide pigments except zinc oxide darkened appreciably in 100 equivalent solar hours; natural mineral pigments proved much more stable, presumably because of their higher purity and crystal perfection. Among the organic binders, a silicone-type material seems most promising. Organic materials may have particular uses as highly efficient emitters in multilayer coating systems. Author

N63-10918 Battelle Memorial Inst., Columbus, Ohio

CONSIDERATIONS OF EMITTANCE AND ABSORPTANCE IN COATINGS FOR SPACE APPLICATIONS

Webster D. Wood and Herbert W. Deem *In* Soc. of Aerospace Mater. and Process Engr. National Symp. on Effects of Space Environment on Materials, St. Louis, May 7, 8, and 9, 1962 10 p 6 refs (See N63-10912 02-01)

Emittance, emissivity, absorptance, reflectance, and transmittance, their usual prefixes, and the relationships among them are defined and discussed. Variations in radiative properties are discussed generally and examples given. Precautions necessary to practical use of the data found in the literature are discussed. The need for a faster and more thorough system of reporting is pointed out, and a suggestion for such a system is mentioned. Author

N63-10919 Avco Corp. Research and Advanced Development Div., Wilmington, Mass.

MATERIALS FOR ROCKET NOZZLES

Joseph M. Williams *In* Soc. of Aerospace Mater. and Process Engr. National Symp. on Effects of Space Environment on Materials, St. Louis, May 7, 8, and 9, 1962 11 p 4 refs (See N63-10912 02-01)

Criteria required for materials selection of rocket nozzle materials are discussed along with a brief discussion of the propellants used. Test experience with materials such as graphite, tungsten, Avcomet, reinforced ceramics, and ablative nozzle materials are included. Author

N63-10920 Emerson Electric Mfg. Co. Thermodynamics and Chemistry Div., St. Louis, Mo.

THERMOSTATIC TEMPERATURE CONTROL DURING ASCENT AND RE-ENTRY OF HYPERVELOCITY SPACE VEHICLES

Rubin Feldman *In* Soc. of Aerospace Mater. and Process Engr. National Symp. on Effects of Space Environment on Materials, St. Louis, May 7, 8, and 9, 1962 55 p 10 refs (See N63-10912 02-01)

(Work sponsored by NASA)

OTS: $5.60 ph, $1.85 mf

Recent advances in the state-of-the-art in the field of active thermostatic temperature control of hyperperformance vehicles are discussed. Emphasis is on debris-producing composite sublimers, chemical kinetics of the sublimed gas, mass transfer and inorganic sublimation. Correlation between laboratory results, in-flight simulation tests and flight test data is made. Author

N63-10946 Rome Air Development Center. Applied Research Lab., Griffiss AFB, N.Y.

INVESTIGATION OF UNCONVENTIONAL COOLING TECHNIQUES

John B. McCormick and Thomas W. Walsh Nov. 1962 49 p 4 refs

(RAS-TM-62-6)

Thermoelectric and ultrasonic cooling techniques were investigated along with cooling by immersion in a cryogenic fluid. The purpose of this effort was to determine the applicability of these techniques for the cooling of electronic equipment. Experimental results are evaluated, a comparison of these techniques has been included, and recommendations concerning the application of each technique are presented. Author

N63-10991 National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

HEAT-TRANSFER AND PRESSURE MEASUREMENTS ON A FLAT-PLATE SURFACE AND HEAT-TRANSFER MEASUREMENTS ON ATTACHED PROTUBERANCES IN A SUPERSONIC TURBULENT BOUNDARY LAYER AT MACH NUMBERS OF 2.65, 3.51, and 4.44

Paige B. Burbank, Robert A. Newlander, and Ida K. Collins Washington, NASA, Dec. 1962 424 p 15 refs

(NASA TN D-1372) OTS: $6.00

The influence of surface projections, both totally and partially immersed in a turbulent boundary layer, on the distribution of heat-transfer coefficients has been determined on 20 configurations. Surface projections cause separations of the local flow; the extent of these separations both upstream and downstream and the magnitude of the resultant interference heat-transfer coefficients are dependent upon the size and cross-sectional shape of the projection, Mach number, Reynolds number, and boundary-layer thickness. The configurations of this investigation include both three-dimensional simple shapes and hardware-type configurations tested on a flat plate with a turbulent-boundary-layer-thickness variation of approximately 10 to 1. The extent of the interference region can be defined by static-pressure measurements, oil-flow technique, or by heat-transfer measurements. Author

N63-10995 Stanford U. Thermosciences Div., Calif.

HEAT TRANSFER WITH LAMINAR FLOW IN CONCENTRIC ANNULI WITH CONSTANT HEAT FLUX AND SIMULTANEOUSLY DEVELOPING VELOCITY AND TEMPERATURE DISTRIBUTIONS

H. S. Heaton, W. C. Reynolds, and W. M. Kays July 1, 1962 386 p 50 refs

(NASA Grant NsG-52-60)

(Rept. AHT-5) OTS: $21.00 ph, $11.78 mf

The problem of convective heat transfer in an annulus with laminar incompressible flow, constant wall heat flux, and simultaneously developing velocity and temperature distributions is considered. The hydrodynamic entry length problem is solved first; then the solution for the combined thermal and hydrodynamic entry length problem is found. Experimental results are obtained to support the analysis. Experimental apparatus is described which was used to measure local heat transfer in the entry region of an annulus using air as a fluid. Good agreement was found between the experimental data and the analysis. Also described is an experimental study of transition from laminar to turbulent flow in an annulus. Transition lengths were measured by means of wall temperature changes. Author

14 HUMAN BEHAVIOR

Includes: crew training and evaluation; piloting; psychological factors.

For simulators see: 10 Facilities.

For related information see: 16 Life Sciences.

N63-10584 Deutsche Versuchsanstalt für Luft- und Raumfahrt, Inst. für Flugmedizin, Bad Godesberg (W. Germany)

"PILOT ERROR"—EIN REDUZIERBARES RISIKO DES LUFTVERKEHRS ["PILOT ERROR"—A REDUCIBLE RISK OF AIR TRAFFIC]

Konrad Steininger Sept. 1962 20 p 23 refs

This study is devoted to the responsibility of the pilot in aircraft accidents. Definite boundaries of performance are established. Of special interest is the time constant of perception and reaction. Also considered is the pilot's capacity for absorption and processing of information as well as his psychological capacities. The causes of pilot failure are studied from two approaches: (1) errors in the training and testing of pilots, and (2) technical deficiencies in equipment and instrumentation. A.S.

N63-10626 National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

A STUDY OF HUMAN PILOTS' ABILITY TO DETECT ANGULAR MOTION WITH APPLICATION TO CONTROL OF SPACE RENDEZVOUS

Roy F. Brissenden Washington, NASA, Dec. 1962 17 p 7 refs

(NASA-TN-D-1498) OTS: $0.50

Tests were made of light objects moving on a low-intensity star background. Six subjects with normal vision participated in the tests conducted inside an inflatable 53-foot darkened radome. Various initial reference separations and rates of object motion that would be anticipated in space rendezvous were utilized. Author

N63-10782 Martin Co. Space Systems Div., Baltimore, Md.

CREW PERFORMANCE DURING SIMULATED LUNAR MISSIONS [Final Report]

Milton A. Grodsky and John P. Bryant Aug. 1962 297 p 39 refs

(NASA Contract NASI-1861)

(ER-12693) OTS: $18.50 ph, $9.11 mf

A study is made of crew performance during simulated lunar landing. The results of the study indicate that no decrement in crew performance during any of the three simulated flights could be

traced to sensory deprivation or confinement. In general, crew performance was excellent on most tasks and no general decrement in performance occurred. However, a number of procedural errors occurred during each of the flights, gradually diminishing between the first and third flights. These procedural errors are discussed in terms of lack of training, lack of display optimization, and lack of practice during the flight period on the more complex tasks. No gross medical or psychological effects were noted during any of the flights. The in-flight exercise program used during each of the simulated flights proved to be capable of maintaining physical endurance. J.R.C.

N63-10945 Aerospace Medical Div. Aerospace Medical Research Labs. (6570th), Wright-Patterson AFB, Ohio

ATTENTION LEVEL AND VISUAL AND AUDITORY MONITORING PERFORMANCE [Final] Technical Documentary Report

Louis T. Pope Aug. 1962 24 p 12 refs

(AMRL-TDR-62-97) OTS: $0.75

The relationship between performance on a monitoring (vigilance) task and level of alertness, as measured by performance on a tracking task, was investigated. Each of 20 male college subjects was tested under each of 10 experimental conditions. The experimental conditions consisted of various combinations of: auditory or visual monitoring; low or high rate of signal input; auditory or visual tracking; and simple or complex tracking problems. The results indicate that for the visual vigilance conditions more signals were missed when the subject was simultaneously engaged in a tracking task; however, this was not true for the auditory vigilance conditions. On both the visual and auditory vigilance tasks the decrement in performance during the 45-minute test period was less when a tracking task was performed simultaneously. Furthermore, the better the subject tracked, or the more frequent the vigilance signals, the greater the likelihood of a signal being detected. Author

15 INSTRUMENTATION

Includes: design, installation, and testing of instrumentation systems; gyroscopes; measuring instruments and gauges; and sensors and transducers.

For related information see: 06 Auxiliary Systems; 08 Communications; 09 Electronics; and 22 Navigation and Guidance.

N63-10614 General Electric Co. Flight Propulsion Lab. Dept., Cincinnati, Ohio

REACTOR INSTRUMENTATION AND CONTROL PROGRESS REPORT NO. 75 [SEPTEMBER 1, 1962 TO NOVEMBER 1, 1962]

Nov. 30, 1962 41 p 3 refs

(Contract AT(40-1)-2847)

(GEMP-75) OTS: $1.00

This report on reactor instrumentation and control covers the following: circulating-ball reactivity control, static switching, capacitance temperature sensor, high-temperature extension of conventional nuclear sensors, development of nuclear sensors, and Monte Carlo shield and reactor analysis. J.R.C.

N63-10633 Army Electronics Research and Development Activity. Missile Meteorology Div., White Sands Missile Range, N. Mex.

AUTOMATIC ROCKET IMPACT PREDICTOR 2 Technical Report

Elmer J. Trawle and Henry Rachele Nov. 1962 10 p 2 refs

(SELWS-M-14)

The Automatic Rocket Impact Predictor 2 (ARIP 2) was designed to improve the capability of impact prediction for unguided, multiple-stage, high-altitude rockets. The system is still in the development stage. ARIP 2 will use analog wind data from each of eight wind instruments mounted on a 500-foot tower and from an automatic tracking pilot-balloon system. Sampling will be performed at the rate of two data points per second. Predetermined wind weighting factors and unit wind effects will be applied to these data to determine the displacement of the rocket impact due to the wind from the surface to 10,000 feet. The displacement will be added automatically and continuously to a wind displacement value (manual input) determined from rawinsonde-measured winds, thus providing a continuous plot (on a range map) of the predicted impact of as many as five rocket stages. For the convenience of the impact predictor (ballistician or meteorologist), the wind data from the tower will be displayed as profiles once each minute and the theodolite data displayed as often as available. Author

N63-10643 Michigan U., Ann Arbor

VOID FRACTION MEASUREMENTS IN A CAVITATING VENTURI Internal Report 17

Willy Smith, Gerald L. Atkinson, and Frederick G. Hammitt Oct. 1962 46 p 12 refs

(NASA Grant NsG-39-60)

(Based on ORA Rept. 03424-7-T) OTS: $4.60 ph, $1.58 mf

A method is described for obtaining precise measurements of local density (or void fraction) in an axially symmetrical cavitating flow regime wherein a heavy fluid such as mercury, molten lead, etc., is used. Significant information regarding the cavitating flow regime in a particular venturi operating with mercury has been obtained. It has been shown that regions have void fractions of the order of only 5%. Author

N63-10644 Mellon Inst., Pittsburgh, Pa.

AN INSTRUMENT FOR MEASURING TORSIONAL CREEP AND RECOVERY

Donald J. Plazek [1962] 25 p 5 refs Presented at the 33rd Annual Meeting of the Society of Rheology, Johns Hopkins U., Oct. 29, 1962

(NASA Grant NsG-147-61)

OTS: $2.60 ph, $0.95 mf

A torsional creep instrument has been built to measure the viscoelastic properties of soft polymeric solids and liquids in the long time region. Special consideration was given to minimizing friction and undesired residual torques which introduce uncertainties in recovery measurements. The essential features are a reasonably low moment of inertia rotor which floats on a liquid and a torsional inductive drive. Details of sample handling are given. The performance of a pair of wattmeter coil units acting together as an inductive torsional drive is described. Measurements can be made on viscoelastic liquids with viscosities as low as 100 poises. Cylindrical liquid samples have been shown to provide an adequate centering force for the floating rotor. Torques as large as 10^4 dyne cm. are produced and residual torques are found to be about 10^{-2} dyne cm. Author

N63-10674 Atomic Energy Commission. Div. of Technical Information, Washington, D. C.

METHODS AND USES OF MASS SPECTROSCOPY

Heinz Ewald and Heinrich Hintenberger (Max-Planck-Institut. für Chemie) July 1962 386 p refs Transl. by JPRS of the Weinheim/Bergstrasse, Verlag Chemie, GmbH, 1953

(AEC-TR-5080) OTS: $4.50

This book on mass spectroscopy covers the following: a short survey of the development of mass spectroscopy, production of ions, ion optics, detection of ions, principles of construction and aids in building mass spectrographs and mass spectrometers, mass and abundance measurements, and applications. J.R.C.

N63-10677 General Dynamics Corp. General Atomic Div., San Diego, Calif.

MEASUREMENTS OF ATMOSPHERIC ION REACTIONS Yearly Technical Summary Report, April 1, 1961-July 31, 1962

R. F. Stebbings July 31, 1962 19 p 2 refs
(Contract DA-49-146-XZ-041)
(GA-3351; DASA-1330)

The topics covered in this summary are: charge transfer in N_2, O_2, and NO; oxygen atom source development; charge transfer in atomic oxygen; and studies of ion-molecule reactions. R.C.M.

N63-10770 Chance Vought Corp. Astronautics Div., Dallas, Tex.

DATA SENSORS AND INFORMATION ACQUISITION

A. M. Mayo, C. L. Buddecke, and G. R. Tenery [1962] 27 p 10 refs Presented at the Intern. Symp. on Basic Environmental Problems of Man in Space, Paris, Oct. 29-Nov. 2, 1962

The problems of data acquisition in space are discussed along with the following techniques: (1) energy-frequency transforms, such as ultraviolet excitation; (2) amplification of energy patterns such as radio and television reception; (3) temporal transforms, such as ultra-high-speed and time-lapse photography; and (4) classification transforms, such as self-programing computer techniques of organizing geometric and temporal sensed energy patterns. R.C.M.

N63-10778 European Atomic Energy Community, Brussels (Belgium)

DÉTECTION DE LA PÉNÉTRATION DES NEUTRONS RAPIDES DANS L'EAU AU MOYEN DE DETECTEURS À SEUIL [DETECTION OF THE PENETRATION OF FAST NEUTRONS IN WATER BY MEANS OF THRESHOLD DETECTORS]

R. Nicks and C. Pleinevaux Joint Nuclear Research Center, Ispra Establishment (Italy), Reactor Physics Dept., Oct. 1962 24 p 2 refs In French; English summary
(EUR-107.f) Available from Belgian American Bank and Trust Co., N.Y., account No. 121.86: 30 Belg. Fr.

This reports gives the activation rates to be expected from some threshold detectors immersed in water and irradiated by a fast neutron source. Author

N63-10780 European Atomic Energy Community, Brussels (Belgium)

DESCRIPTION D'UN NOUVEAU DISPOSITIF COMPLÉMENTAIRE DE LA MICROSONDE DE CASTAING. APPLICATIONS NOUVELLES À LA MICROANALYSE ÉLÉMENTAIRE ET STRUCTURALE [DESCRIPTION OF A NEW ADDITIONAL DEVICE FOR CASTAING MICROANALYZER. NEW APPLICATIONS FOR ELEMENTARY AND STRUCTURAL MICROANALYSIS]

J. Lemaitre and R. Theisen Joint Nuclear Research Center, Ispra Establishment (Italy), Metallurgy and Ceramics Service, Oct. 1962 15 p 17 refs In French; English summary
(EUR-109.f) Available from Belgian American Bank and Trust Co., N.Y., account No. 121.86: 30 Belg. Fr.

A versatile probe-holder was developed for use with the electron beam microanalyzer. The details of this holder and some of its applications are discussed in this report. Author

N63-10781 European Atomic Energy Community, Brussels (Belgium)

EXPERIMENTAL METHODS AND EQUIPMENT FOR DIFFUSION MEASUREMENTS OF RADIOACTIVE RARE-GASES IN SOLIDS (RARE-GAS DIFFUSION IN SOLIDS 7)

F. Felix and P. Schmeling Hahn-Meitner-Institut für Kernforschung, Berlin, Oct. 1962 43 p 153 refs
(Contract Euratom 064-61-8RDD; Joint Euratom/United States Program)
(EUR-111.e) Available from Belgian American Bank and Trust Co., N. Y., account No. 121.86; 50 Belg. Fr.

A literature survey is given on the methods and equipment used for the measurement of release of radioactive raregases in solids, with a discussion of advantages or disadvantages. Continuous methods with sweepgas or circulation and various discontinuous methods are discussed, and apparatus used for Hahn emanation-DAD- or PAD-experiments are described. In addition, references are given concerning sampling purifying and measuring of radioactive raregases as well as materials to be used for measuring rare-gas diffusion at high temperatures in oxygen sensible systems. Author

N63-10785 Compagnie Generale de Télégraphie sans Fil, Paris (France)

EQUIPMENT POUR LA MÉSURE DE LA PROPAGATION DES ONDES MILLIMÉTRIQUES (EQUIPMENT FOR MEASURING MILLIMETRIC WAVE PROPAGATION)

July 1962 21 p In French and English
(Contract F48 MWP N58)
(Doc. 1250)

Equipment is designed to measure atmospheric attenuation in the range of wavelengths of 8 to 3 mm and beyond. The equipment consists essentially of the following: a transmitter unit which can be fitted with a series of 6 (carcinatron 0) tubes for the continuous exploration of the complete range of frequencies; a superheterodyne receiver unit which can be fitted with local oscillator tubes of the carcinotron type; and a reflecting plane to send back to the receiver the waves sent out by the transmitter. J.R.C.

N63-10790 General Electric Co. Advanced Electronics Center, Ithaca, N. Y.

ROCKET-BORNE IONOSOUNDER EQUIPMENT DEVELOPMENT

Leonard C. Humphrey, M. I. Davis, T. Kent, J. A. Lash, J. C. Palmer, C. R. Roberts, and R. H. Wood Aug. 1962 57 p 5 refs
(Contract AF 19(604)-7221)
(AFCRL-62-900)

This report describes equipment consisting of a three-frequency topside ionospheric sounding system capable of measuring natural gradients and manmade perturbations in the topside of the ionosphere. Fabricated equipment includes a 250-watt transistor high-frequency radar transmitter, receiver, programer, power inverter, and inflatable plastic HF antenna structures. Author

N63-10866 Rohm and Haas Co., Huntsville, Ala.

Quarterly Progress Report on Engineering Research, June 15, 1962 to September 15, 1962 [A CALORIMETER FOR THE MEASUREMENT OF THE SPECIFIC HEAT OF SOLID PROPELLANTS]

Edwin L. Allen, Harvey T. Downing, and Thomas E. Stonecypher 29 p 3 refs
(Contract DA-01-021-ORD-11878)
(P-62-20)

A dropping-type calorimeter was designed and constructed for use with propellants and explosives. Protective shields were provided to reduce hazards to personnel operating the calorimeter and to minimize equipment damage in the event of fire or explosion. The main calorimeter shield was subjected to the detonation of 45 g of Composition C-4 explosive, and the capsule assembly shield was subjected to the detonation of 40 g of Composition C-4 explosive. Both shields survived the test. Aluminum oxide was used to test the accuracy of the calorimeter. The arithmetic average error was +0.28% with a standard deviation of 0.40% Author

N63-10869 Los Alamos Scientific Lab., N. Mex.

QUARTERLY STATUS REPORT OF THE LASL PLASMA THERMOCOUPLE DEVELOPMENT PROGRAM FOR PERIOD ENDING OCTOBER 20, 1962

Nov. 1962 14 p
(Contract W-7405-eng-36)
(LAMS-2796) OTS: $0.25

This report on plasma thermocouple development covers the following: radiation shield experiment, in-pile testing, a variable spacing cell application, spectroscopic studies of cesium plasmas, and materials and fabrication development. J.R.C.

N63-10876 Aeronautical Research Labs., Melbourne (Australia)
A VACUUM MICROBALANCE FOR HIGH TEMPERATURE OXIDATION STUDIES Metallurgy Note 15
T. Mills Apr. 1962 17 p 5 refs
(ARL/MET-15)

A Gulbransen-type vacuum microbalance is described, operating under constant load, with the incorporation of eddy-current damping to give it stability in vacuum not hitherto obtained with this type of balance. Author

N63-10889 Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena
AN ELECTROMAGNETIC FLOWMETER FOR LOW CONDUCTIVITY FLUIDS
Niels R. Balling and Benjamin V. Connor Aug. 30, 1962 27 p 19 refs
(NASA Contract NAS7-100)
(JPL-TR-32-329) OTS: $2.60 ph, $1.01 mf

The measurements of the flow of salt water, tap water, distilled water and n-propyl alcohol by a simply constructed, permanent-magnet flowmeter and associated electronic circuitry are reported. The electromagnetic flowmeter (EMFM) described was developed for measuring the fluctuations in mass-flow rate associated with the study of transient hydraulic phenomena. The system is capable of monitoring fluid-flow fluctuations in the frequency range from 0 cps (steady state) to an estimated maximum frequency of 10 kc. The flow sensitivity, i.e., increment in output amplified voltage across the electrode per increment in fluid-flow velocity, is virtually independent of the fluid conductivity ($\simeq 0.05$ mv/cm/sec) over a range of 0.2 to 5×10^{-8} mho/cm. The potential difference developed across the flowmeter electrodes was measured for fluid velocities ranging from about 2 to 1500 cm/sec. For fluid velocities below approximately 600 cm/sec the observed potential difference followed theory, but, above this, velocity deviations from theory were apparent. Included are magnetic-field measurements along directions normal to the centerline of the magnetic-pole faces. Author

N63-10954 Polytechnic Inst. of Brooklyn. Microwave Research Inst., N. Y.
THEORY AND DESIGN OF A SUBSONIC SPECTRUM ANALYZER Scientific Report No. 1
Theordore Bially Apr. 26, 1962 52 p 6 refs
(Contract AF 19(628)-375)
(PIBMRI-1013-62; AFCRL-62-368)

The coherent memory filter is analyzed in its application as a spectrum analyzing device and is shown to be capable of performing a spectrum analysis with a minimum of mean squared error in a minimum of time. The instrument described will provide a visual display of the low-frequency spectral components of any arbitrary waveform which is applied to its input terminals. In particular, it will analyze frequencies up to four cycles per second with a resolution, or uncertainty, of better than sixty-seven thousandths of a cycle. The signal must be available for analysis for a period of time of not less than fifteen seconds. Theoretical and practical considerations in the instrumentation of the device are discussed from the system design viewpoint. Author

16 LIFE SCIENCES

Includes: biology; exobiology; physiology; medicine; life support systems; radiation effects on biological systems; and space sickness.

For related information see: 14 Human Behavior; and 28 Space Radiation.

N63-10583 Joint Publications Research Service, Washington, D. C.
APPARATUS FOR DETERMINING THE NUMBER OF MICROBES IN THE AIR
Adolf Zampach Nov. 20, 1962 7 p Transl. of Czech. Pat. No. 93066, Rep. of Czechoslovakia, Bur. of Pat. and Inventions 3 p
(JPRS-16407) OTS: $1.10

A device is described and illustrated for the analysis of microorganisms in the air by continuous sampling. The mechanism consists of a drum surrounded by a band of solid growth medium which makes a rotation in 12 hours. The air intake capacity can be adjusted from 0.25 to 3.00 liters per minute. After exposure, the band is incubated for 48 hours in the laboratory. Colonies can then be counted and related to the time interval. R.C.M.

N63-10589 Los Alamos Scientific Lab., N. Mex.
BIOLOGICAL AND MEDICAL RESEARCH GROUP (H-4) OF THE HEALTH DIVISION Annual Report, July 1961 through June 1962
W. H. Langham and T. L. Shipman Nov. 9, 1962 319 p 166 refs
(Contract W-7405-eng-36)
(LAMS-2780) OTS: $4.00

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CHAPTER 2: MAMMALIAN METABOLISM SECTION p 17-84 52 refs
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CHAPTER 5: CLINICAL INVESTIGATIONS SECTION p 181-210 15 refs
CHAPTER 6: CELLULAR RADIOBIOLOGY SECTION p 211-245 31 refs
CHAPTER 7: MOLECULAR RADIOBIOLOGY SECTION p 246-316 39 refs

N63-10605 Atomic Energy Commission. Div. of Technical Information, Washington, D. C.
AN ATOMIC RADIATION BIBLIOGRAPHY A list of Reports Submitted to the United Nations Scientific Committee on the Effects of Atomic Radiation (Supplement)
Alfred W. Klement, Jr., comp. May 15, 1962 32 p 767 refs
(TID-3909(Suppl. 1)) OTS: $0.75

N63-10610 Electric Boat Div., General Dynamics Corp., Groton, Conn.
RESEARCH AND DEVELOPMENT OF A LIQUID-GAS CONTACTOR FOR PHOTOSYNTHETIC GAS EXCHANGERS [Final] Report
Harold Wallman, John L. Dodson, Victor A. Speziali, Allen E. Rabe, Russell J. Nickerson, and Rodney R. Cordeiro Wright-Patterson AFB, Ohio, Biomedical Lab., Sept. 1962 43 p 2 refs
(Contract AF 33(616)-8008)
(U413-62-108; AMRL-TDR-62-101) OTS: $1.25

This study was conducted to design, fabricate, and test a liquid-gas contactor and liquid-gas separator system capable of operation as a photosynthetic gas exchanger. The system is designed to handle the oxygen requirements of one man and to be capable of operation under weightless conditions. The gas-exchange system consists of four major components: (1) a multipass light chamber, (2) an agitated liquid-gas contactor, (3) a centrifugal liquid-gas separator, and (4) an instrument console. This system has the capability of supporting one man under normal gravity and should be capable of operation under weightless conditions. Author

N63-10621 Joint Publications Research Service, Washington, D.C.
MEDICAL AND BIOLOGICAL ASPECTS OF USSR SPACE FLIGHTS
I. Akulinichev et al Nov. 16, 1962 20 p Transl. of five articles from Med. Rabotnik (Moscow), Aug. 17, 1962 p 3
(JPRS-16227) OTS: $1.60

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4. THE ATMOSPHERE IN A SPACE SHIP Yu. Ivanov (Acad. of Pedagogical Sci.) p 11-14
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N63-10654 Pasadena Foundation for Medical Research, Calif.

A COMPARATIVE STUDY OF HUMAN AND MONKEY LEUKOCYTES IN CULTURE

Yasushi Ohnuki, Akio Awa, and C. M. Pomerat Brooks AFB, Tex., School of Aerospace Medicine, Sept. 1962 11 p 8 refs
(Contract AF 41(657)-357)
(SAM-TDR-62-99)

To develop a satisfactory culture procedure for rhesus monkey *(Macaca mulatta)* leukocytes, several technical variations of the routine method were investigated. Those included in the present study were (1) the use and the amount of different kinds of phytohemagglutinins, (2) the separation of erythrocytes after preservation or centrifugation, (3) sera derived from the horse, the calf, and the monkey for supplementing the culture medium, and (4) the ratio of host serum containing leukocytes to the nutrient fluid. None of these factors gave satisfactory results for monkey samples, but all were useful for human cells. Author

N63-10655 Institute of Andean Biology, Lima (Peru)

THE INFLUENCE OF HIGH ALTITUDES ON THE ELECTRICAL ACTIVITY OF THE HEART. ELECTROCARDIOGRAPHIC AND VECTORCARDIOGRAPHIC OBSERVATIONS IN ADOLESCENCE AND ADULTHOOD

Dante Penaloza, Raúl Gamboa, Emilio Marticorena, Max Echevarría, Juan Dyer, and Edilberto Gutiérrez Brooks AFB, Tex., School of Aerospace Medicine, Aug. 1962 26 p 84 refs
(Contract AF 41(657)-249)
(SAM-TDR-62-87)

Electrocardiographic and vectorcardiographic observations were obtained in 550 normal subjects—300 at sea level and 250 in Morococha, 14,900 feet above sea level. A comparative study was made in three age groups ranging from 15 to 60 years. The ventricular activation process shows important differences between subjects living in the two places studied. Author

N63-10678 Aerospace Medical Div. Aerospace Medical Research Labs. (6570th), Wright-Patterson AFB, Ohio

PHYSIOLOGICAL PROTECTION OF THE CSU-4/P HIGH-ALTITUDE PRESSURE SUIT [Final Report, June 1958 to Jan. 1959]

Charles L. Wilson Sept. 1962 22 p 61 refs
(AMRL-TDR-62-112) OTS: $0.75

The CSU-4/P high-altitude bladder pressure suit was designed mainly for quick donning. Each of 15 subjects who wore the suit ensemble was rapidly decompressed from 282 mm Hg chamber pressure (7.6 km) to 42 mm Hg chamber pressure (19.8 km) in an average of 1.5 seconds, and then further to 33.6 mm Hg (21.4 km). All subjects were able to remain at 33.6 mm Hg for 5 minutes without any difficulty. Each of 14 of the subjects was again successfully exposed to the same profile except that one hand was bare and the other hand was protected by an unpressurized leather flying glove. Eight subjects were easily able to remain at 8 to 3 mm Hg chamber pressure (30.6 to 36.7 km) continuously for 120 minutes. One subject wore the CSU-4/P pressure suit ensemble during a special decompression study. Author

N63-10793 National Aeronautics and Space Administration, Washington, D. C.

PROCEEDINGS OF CONFERENCE ON SPACECRAFT STERILIZATION Held Under the Auspices of the NASA Biosciences Programs, July 9, 1962

Freeman H. Quimby, ed. Dec. 1962 104 p
(NASA-TN-D-1357) OTS: $2.50

The proceedings of a conference on spacecraft sterilization are presented. The information presented is essentially a transcript of the discussions. Recommendations of the participants for research and development are appended. Author

N63-10879 New York Eye and Ear Infirmary, N.Y.

EFFECTS OF THERMAL ENERGY ON RETINAL FUNCTION [Final] Technical Documentary Report

Jerry Hart Jacobson, Blossom Cooper, and Harold W. Najac Wright-Patterson AFB, Ohio, Life Support Systems Lab., Aug. 1962 78 p 4 refs
(Contract AF 33(616)-7685)
(AMRL-TDR-62-96) OTS: $2.00

The retinas of pigmented, grey chinchilla rabbits were exposed to the visible, and to the visible and near infrared parts of the spectrum to determine the retinal burn threshold. The study included the variation of four primary parameters: the rate of delivery of energy, the retinal image size, the exposure time, and the spectral characteristics of the source. Analysis of the data indicated the following: for a given irradiance, the dose necessary to produce a threshold burn increased with the size of the retinal image diameter; for equal total irradiance, a higher dose was necessary when the near infrared was included in the spectrum than when the visible alone was present; and for a given retinal image, the threshold dose is determined as a function of the irradiance. Author

N63-10906 Aerospace Medical Div. Aerospace Medical Research Labs. (6570th), Wright-Patterson AFB, Ohio

BOUNDARY LAYER NOISE MEASUREMENTS OF THE F-102A AIRCRAFT [Final] Technical Documentary Report

Frank J. Leech and Virgil E. Sackschewsky Biomedical Lab., Aug. 1962 24 p 11 refs
(MRL-TDR-62-71) OTS: $0.75

Inflight noise measurements were made on an F-102A aircraft at speeds up to Mach 0.90 at 5000 ft and up to Mach 1.16 at 25,000 ft. Boundary layer pressure fluctuations were measured at 7 positions on the aircraft using specially designed condenser microphones. The sensing plates of the microphones were mounted flush with the aircraft skin. Internal measurements were made at 5 positions using conventional condenser microphones. The measured sound pressure levels are discussed as functions of IAS, octave bands, Mach number, and altitude. The results show a wide variation in the dependence of SPL on IAS, dependence varying between 0.55th and 4.9th power of the IAS. A sharp drop in SPL is observed at several positions as the aircraft passes through Mach 0.83. A spectrum shape change is observed as the aircraft reaches and passes through the vicinity of Mach 0.83, the peak of the spectrum being shifted to higher frequencies. There are also indications that the apparent noise reduction through the aircraft skin derived from these data is not constant but depends on both the IAS and altitude. Author

N63-10932 McDonnell Aircraft Corp., St. Louis, Mo.

EFFECT OF SPACE ON MAN

A. V. Montgomery, Jr. *In* Soc. of Aerospace Mater. and Process Engr. National Symp. on Effects of Space Environment on Materials, St. Louis, May 7, 8 and 9, 1962 8 p 7 refs (See N63-10912 02-01)

A few principles involved in the definition of a spacecraft environment are outlined and exemplified. These principles involve individual variations, duration of stimulus, discrete range of acceptability, and interactive effects between simultaneously applied environmental factors. Author

N63-10944 Cornell Aeronautical Lab., Inc., Buffalo, N. Y.
EXPLORATORY INVESTIGATION OF THE MAN AMPLIFIER CONCEPT [Final] Technical Documentary Report [July 1961-Apr. 1962]
D. C. Clark, N. J. De Leys, and C. W. Matheis Wright-Patterson AFB, Ohio, Behavioral Sciences Lab., Aug. 1962 73 p 10 refs
(Contract AF 18(600)-1922)
(CAL-VO-1616-V-1; AMRL-TDR-62-89) OTS: $2.00

Preliminary investigations were conducted to ascertain some of major problems requiring more research before feasibility of Man Amplifier concept can be evaluated. Study areas included: possible Air Force applications as basis for selecting maximum load-carrying capability, human factors from standpoints of body kinematics and physical anthropology, structures and mechanical design, and servosystem and power requirements. Dynamic response characteristics of elbow-joint amplifier, determined theoretically and experimentally, were compared. Comparison of position tracking tests performed with and without power boost provided by elbow-joint servo indicated that power boost did not increase tracking error above that exhibited by unaided operator. It was concluded: (1) duplication, in Man Amplifier, of all human joint motion capability is impractical; (2) experimentation is necessary to determine essential joints, motion ranges, and dynamic responses; (3) inability to counter overturning moments will, in many instances, limit load-handling capability; (4) conventional valve-controlled hydraulic servos are unsuitable for Man Amplifier; (5) particularly difficult problems will be encountered in general areas of mechanical design, sensors, and servomechanisms. Author

N63-10982 Joint Publications Research Service, Washington, D.C.
SPACE BIOLOGY
O. Gazenko Dec. 14, 1962 13 p Transl. from Nedelya (Moscow), Aug. 5-11, 1962 p 6-7
(JPRS-16677) OTS: $1.60

This article discusses the role of biology in the space sciences in terms of the effects of the space environment on living organisms, and of the methods for selecting and training the astronaut. The space environment problems covered are weightlessness, overloading, radiation, and psychological stresses. The importance of considering these psychological factors when selecting astronauts is considered, and methods of training under isolated conditions are described. R.C.M.

N63-10985 Joint Publications Research Service, Washington, D.C.
NEUROCYBERNETICS
S. N. Braynes, A. V. Napalkov, and V. B. Svechinskiy Dec. 11, 1962 173 p 141 refs Transl. of the book "Neyrokibernetika", Moscow, State Publishing House for Med. Lit., 1962 172 p
(JPRS-16638) OTS: $12.50

This book analyzes certain questions and dwells on certain aspects in the field of neurocybernetics. The subject matter covered includes the following: the content of neurocybernetics, elements of the theory of neural networks, systems capable of independently developing new programs, processing accumulated information, problems of classifying shapes and concept formation by automata, and the use of neurocybernetics in physiology and medicine. J.R.C.

17 MACHINE ELEMENTS AND PROCESSES

Includes: bearings, seals, pumps, and other mechanical equipment; lubrication, friction, and wear; manufacturing processes and quality control; and materials fabrication, handling, and inspection.

For related information see: 06 Auxiliary Systems.

N63-10576 Joint Publications Research Service, Washington, D. C.
AUTOMATION OF PRODUCTION PROCESSES BY MEANS OF COMPUTER EQUIPMENT
Nov. 29, 1962 16 p Transl. of conference report from Mekhaniz. i Avtomatiz. Proizv. (Moscow), no. 9, Sept. 1962 p 56-58
(JPRS-16410) OTS: $1.60

Application of computer techniques in the automation of production processes is discussed. Production processes in the following industries are discussed: iron and steel; rolling mills and milling machines; chemical processing; and farm implements. R.C.M.

N63-10659 Rolla Metallurgy Research Center, Bureau of Mines, Mo.
USE OF DEPLETED URANIUM IN BEARING METALS AND LOW-ALLOY STEELS Final Metallurgical Report, Apr. 1, 1959 to June 30, 1962
L. W. Higley Washington, AEC Div. of Tech. Information, Nov. 1962 44 p 10 refs
(TID-8212) OTS: $1.00

The use of depleted uranium as a constituent in antifriction alloys and as an alloying addition to steel was investigated. Casting methods were developed for binary and ternary lead-, tin-, and copper-base alloys containing up to 33 percent uranium. A few of the experimental alloys were superior in some respects to commercial babbitt materials. Uranium was added in amounts up to 1.5 percent to a medium-carbon 2 percent nickel steel. No significant improvement in tensile strength, ductility, or hardenability of the steels could be attributed to the addition of uranium. Radiation surveys were made and the data are tabulated. Author

N63-10662 Westinghouse Electric Corp., Blairsville, Pa.
VACUUM ARC MELTING OF A TUNGSTEN ALLOY (TUNGSTEN-MOLYBDENUM-COLUMBIUM [Final Report, Aug. 1, 1961 to July 1, 1962]
George A. Reimann Wright-Patterson AFB, Ohio, Directorate of Materials and Processes, Oct. 1962 82 p 7 refs
(Contract AF 33(616)-7459)
(ASD-TDR-62-781)

A satisfactory melting technique was established for the production of fine-grained, homogeneous, high-quality, tungsten-base alloy ingots. The 88W-6Mo-6Cb alloy originally selected for the program was discarded because of ingot cracking and replaced by a 92W-6Mo-2Cb alloy. The reduction of columbium from 6 to 2 percent permitted the production of sound 3-1/2 inch diameter ingots, 6 to 9 inches in length. Macroexamination revealed a mixture of fine, equiaxed grains and short, thin columnar grains. Seven ingots of the 92-6-2 composition were extruded successfully at 4000° F, using ratios of 4.4:1, 5.7:1, and 7.5:1. The extruded material was forged and rolled to determine workability. A time, temperature, recrystallization study was conducted on forged specimens of the 92-6-2 alloy. Author

N63-10665 Westinghouse Electric Corp., Blairsville, Pa.
THE EXTRUSION, FORGING, ROLLING, AND EVALUATION OF REFRACTORY ALLOYS [Final Report, Aug. 1, 1961-July 1, 1962]
D. R. Carnahan and J. A. Visconti Wright-Patterson AFB, Ohio, Directorate of Materials and Processes, Oct. 1962 114 p
(Contract AF 33(616)-8325)
(ASD-TDR-62-670)

Metallurgical programs were conducted on the extrusion, forging, and rolling of arc cast Mo+25%W+0.1%Zr, Mo+0.5%Ti+0.08%Zr+0.02%C and W+0.57%Cb alloys. Each of the three alloys has been worked successfully by extrusion and subsequent reworking. Extrusion temperatures exceeding 4200° F have been reached in the working of a group of tungsten base alloys. The maximum temperature attained to date has been 4320° F. Author

N63-10670 General Mills Electronics Group, Minneapolis
REMOTE HANDLING TECHNOLOGY AND EQUIPMENT INVESTIGATION Phase I Report
R. Karinen, J. Figenshau, W. Hainer, R. Sullivan, E. Hamernik, R. Hakomaki, and A. Novak Kirtland AFB, N. Mexico, Development Directorate, Nov. 1962 200 p 226 refs
(Contract AF 29(601)-5219)
(GMI-2332; AFSWC-TDR-62-117)

This report presents a general description of the types of remote handling equipment in existence, illustrations and specifications of standard manipulators available, lists of remote handling equipment manufacturers throughout the world, and a comprehensive bibliography of available literature. Technological progress and advanced developmental concepts in the field of remote manipulation are also presented. Author

N63-10692 Horizons Incorporated, Cleveland, Ohio
STUDIES OF THE REINFORCEMENT OF METALS WITH ULTRA HIGH STRENGTH FIBERS (WHISKERS) Final Report, 28 Aug. 1961-27 Sept. 1962
Bertram C. Raynes and Robert H. Kelsey Oct. 10, 1962 49 p
(Contract NOw 62-0235-c)

High-strength aluminum oxide fibers (whiskers) have been used to reinforce 80-20 nickel-chromium alloy and iron on a laboratory scale. The tensile strength of the nickel-chromium alloy was increased 28 percent by the incorporation of 3.8 weight percent alumina whiskers, with corresponding lower levels of reinforcement at lower fiber loadings. The tensile strength of hydrogen-reduced iron was increased both at room temperature and at 900° F. Theoretical calculation of the reinforcement which can be expected from randomly oriented fibers indicates that the observed increases in tensile strength are in the correct order of magnitude. Author

N63-10693 Universal-Cyclops Steel Corp. Refractomet Div., Bridgeville, Pa.
MOLYBDENUM SHEET ROLLING PROGRAM Interim Report No. 18, Covering Period July 25, 1962 to Oct. 25, 1962
W. A. McNeish Oct. 25, 1962 24 p
(Contract NOas 59-6142-c)

Two eight-inch-diameter Mo+0.5%Ti ingots were melted, extruded, and prepared as forging billets. The billets have been hot forged to sheet bar. TZM billets have been hot forged and applied to the rolling schedules. Bend-transition test results on recrystallized Mo+0.5%Ti and TZM sheet are presented. Short transverse tensile-test results on Mo+0.5%Ti containing 25 to 96 percent cold work are included. Annealing time-temperature curves have been constructed for TZM, Mo+0.5%Ti, and unalloyed molybdenum. Author

N63-10705 Boeing Co., Seattle, Wash.
MANUFACTURING METHODS FOR "HOT STRUCTURES" Section II: Final Technical Engineering Report, 15 Sept. 1960-15 Mar. 1962
J. Claus and W. Seip Wright-Patterson AFB, Ohio, Manufacturing Technology Lab., Aug. 1962 264 p
(Contract AF 33(600)-39542)
(ASD-TR-62-7-795, Sect. II)

Environmental life tests, preceded by test-facility checkout tests, were conducted on a 10.5-foot-long "Hot Structures" model component. The model was fabricated from the superalloy material Rene' 41 except for the lower surface skin panels which utilized HS-25. The model successfully sustained the test conditions of load and maximum external surface temperatures to 2000° F without permanent deformation or other damage to the primary structure. Author

N63-10713 Ohio State U. Research Foundation, Columbus
X-RAY IMAGE SYSTEM FOR NONDESTRUCTIVE TESTING OF SOLID PROPELLANT MISSILE CASE WALLS AND WELDMENTS Quarterly Progress Report No. 4 [Mar. 21 to June 20, 1962]
Jay P. Mitchell, Merle L. Rhoten, and Robert C. Mc Master June 1962 38 p 9 refs
(Contract DA-33-019-ORD-3383)
(WAL-TR-142.5/1-4)

A television X-ray image enlargement system has been developed for in-motion examination of missile case materials and weldments. This system is based upon the use of small-diameter photoconductive television camera tubes as direct sensing media for penetrating radiations such as X-rays. Author

N63-10725 ARINC Research Corp., Washington, D.C.
SPECIAL REPORT ON ACCURACY OF AFM 66-1 REPORTING
Harald R. Leuba and David Van Tijn July 20, 1962 24 p
(Contract AF 33(657)-7382)
(Publ. 206-3-315)

This report is concerned with methods of checking and, to a certain extent, purifying the data base of Air Force maintenance and logistics management. The methods used for measuring the information content of 66-1 data have been shown to work. The results obtained are not conclusive, due to the pilot nature of the study. They do, however, point up the potentialities of this kind of investigation. With additional effort it will be possible to evaluate both the degree and the nature of inaccuracies in 66-1 reporting, and thus to obtain a measure of the confidence with which these data may be employed in Air Force support management. J.R.C.

N63-10748 Army Missile Command, Redstone Arsenal, Ala.
SAFETY CONSIDERATIONS WITH ELECTROEXPLOSIVE DEVICES
R. E. Betts Nov. 26, 1962 21 p
(AMC-RK-TR-62-10)

This report defines and describes the general makeup of electroexplosive devices (EED). It covers the three basic electrical hazards of electrostatic, radio frequency energy, and induced currents, and the methods by which these hazards cause accidental initiation. General safeguards in designing and handling EED's for improved safety are included. Author

N63-10754 Aro, Inc., Arnold Air Force Station, Tenn.
EVALUATION OF A GAS BEARING PIVOT FOR A HIGH AMPLITUDE DYNAMIC STABILITY BALANCE
A. E. Hodapp, Jr. Arnold Engineering Development Center, Dec. 1962 20 p 3 refs
(Contract AF 40(600)-1000)
(AEDC-TDR-62-221)

The results of a study of the load capacity and damping level of a gas journal bearing are presented. Experimental data indicate that the bearing is capable of supporting radial loads in excess of 300 pounds, and that the damping parameter has some inverse relationship to frequency which is determined by the radial load. It is shown that the damped motion of the gas bearing can be approximated adequately with the viscous-damping equation. Author

N63-10774 European Atomic Energy Community, Brussels (Belgium)
ELECTRON BEAM WELDING OF SINTERED ALUMINIUM
M. Meulemans, D. Tytgat, J. Van Audenhove (CEN), J. Briola, and P. Jehenson (Euratom) Centre d'Étude de l'Energie Nucléaire, Mol (Belgium), Oct. 1962 22 p 20 refs
(Contracts Euratom 001-60-4 ORG-B and 022-61-7 ORG-B)
(EUR-39.e) Available from Belgian American Bank and Trust Co., N.Y., account No. 121.86: 30 Belg. Fr.

The high gas content of normal SAP (sintered aluminum products) caused two phenomena which limited the possibilities of welding

by electron beam bombardment: (a) ionization and (b) metallic projections. Resulting porosity in the welded zone has been observed. High temperature testing under pressure has been used to verify the quality of the welds. Use of external pressure on the tube during welding leads to high-quality closures equal to or superior to other types of welds because of the very high, localized heating. Electron beam welding can be systematically used as a quality test for gas content in the material. Author

N63-10787 Rock Island Arsenal Lab., Ill.
WEAR AND CORROSION TENDENCIES OF MOLYBDENUM DISULFIDE CONTAINING GREASES Technical Report
S. Fred Calhoun Aug. 15, 1962 23 p 19 refs
(RIA-62-2752) OTS: $0.75

The tendency of molybdenum disulfide to increase the wear of greases is shown by results of laboratory tests. The extreme pressure properties of greases were increased by the addition of the molybdenum disulfide. It also promotes rusting of ferrous metals when added to grease. Author

N63-10867 Oak Ridge National Lab., Tenn.
FABRICATION AND ASSEMBLY OF A TEFLON DROPPING-MERCURY ELECTRODE
Helen P. Raaen, R. J. Fox, and V. E. Walker Nov. 30, 1962 38 p 9 refs
(Contract W-7405-eng-26)
(ORNL-3344) OTS: $1.00

A procedure was developed for fabricating a Teflon dropping-mercury electrode that has been shown experimentally to be satisfactory for polarography in glass-corroding media. Author

N63-10896 Massachusetts Inst. of Tech. Div. of Sponsored Research, Cambridge
EVALUATION OF ELECTRON BEAM WELDING FOR FABRICATION OF ULTRA HIGH STRENGTH STEEL ROCKET MOTOR CASES
R. E. Travis, V. P. Ardito, and C. M. Adams, Jr. Sept. 1962 60 p 5 refs
(Contract NOw-60-0417(FBM))

Reliable tungsten inert gas and electron beam welding procedures have been established for the fabrication of low-alloy ultra-high-strength sheet steels. Welds have been generated which exhibit yield strengths in the 230,000 psi range, and uni-axial ultimate tensile strengths in the 280,000 psi range, and as high as 320,000 psi. Biaxial ultimate tensile strengths in the 320,000 psi range and as high as 357,000 psi have also been realized. Author

N63-10929 Directorate of Materials and Processes, Aeronautical Systems Div., Wright-Patterson AFB, Ohio
LUBRICATION IN SPACE ENVIRONMENTS
R. L. Adamczak, R. J. Benzing, and H. Schwenker *In* Soc. of Aerospace Mater. and Process Engr. National Symp. on Effects of Space Environment on Materials, St. Louis, May 7, 8, and 9, 1962 12 p (See N63-10912 02-01)

Solid, semisolid and liquid lubricants, hydraulic fluids, heat transfer fluids, and novel lubrication techniques are discussed with respect to the current state-of-the-art and the future capabilities of these various materials and/or their application. The severe environmental conditions of space are compared against both the current and future state-of-the-art in the field of lubrication and energy-transfer media. Author

N63-10930 National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A CRITICAL APPRAISAL OF MATERIALS TESTING
Henry E. Frankel *In* Soc. of Aerospace Mater. and Process Engr. National Symp. on Effects of Space Environment on Materials, St. Louis, May 7, 8, and 9, 1962 13 p 8 refs. (See N63-10912 02-01)
OTS: $1.60 ph, $0.80 mf

Examples illustrating the comparative effects of testing in a "space environment" as opposed to testing in a laboratory after exposure are presented. Author

N63-10931 National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
BEARINGS FOR VACUUM OPERATION—PHASE I
Harold E. Evans and Thomas W. Flatley *In* Soc. of Aerospace Mater. and Process Engr. National Symp. on Effects of Space Environment on Materials, St. Louis, May 7, 8, and 9, 1962 30 p 4 refs (See N63-10912 02-01) Previously processed as NASA-TN-D 1339; for abstract see N62-12330 07-17

N63-10933 Lockheed Missiles and Space Co. Research Labs., Palo Alto, Calif.
REPORT ON THE LMSC SPACECRAFT MATERIALS RELIABILITY PROGRAM
C. O. Matthews and W. L. Finch *In* Soc. of Aerospace Mater. and Process Engr. National Symp. on Effects of Space Environment on Materials, St. Louis, May 7, 8, and 9, 1962 72 p 58 refs (See N63-10912 02-01)
(Contract AF 04(647)-787)

Information is summarized on the applicable spacecraft environment, spacecraft materials requirements, the evaluation of environmental effects on materials, and the selection of promising materials. A spectrum of materials is covered, including surface coatings and finishes, optics and filters, lubricants, sliding electrical contacts, adhesives, seals, electronics component materials, antennas, solar cells, and infrared detectors. Author

N63-10934 Lockheed Missiles and Space Co., Palo Alto, Calif.
PERFORMANCE OF LUBRICANTS AND THERMAL CONTROL MATERIALS UNDER SIMULATED SPACE CONDITIONS
R. E. Mauri *In* Soc. of Aerospace Mater. and Process Engr. National Symp. on Effects of Space Environment on Materials, St. Louis, May 7, 8, and 9, 1962 22 p (See N63-10912 02-01)
(Contract AF 04(647)-787)

The gross effects of space environment on typical materials for spacecraft applications are briefly discussed. Equipment and experimental procedures used for testing and selecting materials in support of a typical high-reliability satellite hardware program are described. Experimental details and results on the effect of high vacuum and operating conditions on oils, greases, and dry-film lubricants for bearings are presented. Also discussed are applications of thermal control materials and results of environmental testing of solar reflectors, such as white paints, in the presence of intense ultraviolet radiation in vacuum. Author

N63-10947 Rocketdyne, Canoga Park, Calif.
INVESTIGATION OF CONDENSING VAPOR LUBRICATED SELF-ACTING JOURNAL BEARINGS Annual Report for Period 1 Oct. 1961 through 30 Sept. 1962
W. Unterberg, J. S. Ausman, and G. K. Fischer Nov. 30, 1962 p 138 16 refs
(Contract Nonr-3617(00))
(R-3911)

The operating characteristics of condensing vapor self-acting journal bearings were investigated analytically and a steam bearing experiment was initiated. Thermohydrodynamic considerations suggest the isothermal equilibrium behavior of the lubricant. "Linearized ph" analyses are carried out for an infinite and a finite heat-transfer model. For the infinite length isothermal full plain journal bearing with

constant lubricant mass, the condensing vapor operation results in a bearing pressure limit at the saturation vapor pressure value. The load capacity of the condensing vapor bearing is correspondingly reduced below that of the noncondensing bearing. The experimental steam bearing rig and steam generation system and their operation are described. Author

N63-10965 Aerojet-General Corp., Azusa, Calif.
PLASMA-ARC SPRAYED FREE-STANDING SHAPES FOR RADIATION-COOLED THRUST CHAMBERS
S. E. Bramer [1962] 18 p Presented at the ASD-NASA Refractory Composites Working Group Meeting, Dayton, Ohio, June 16-19, 1962

The temperatures imposed on radiation-cooled thrust chambers in some applications make it necessary to employ refractory metals. Molybdenum was chosen for one of these applications because of the vast experience accumulated in oxidation-resistant coatings for this material as compared to other refractory metals. Due to excessive cost and fabrication difficulties, which have generally been encountered with forming and welding molybdenum sheet-metal structures, it was necessary to investigate other means to fabricate molybdenum structures. The deposition of metal powders on a mandrel by the plasma-arc spray technique and followed by sintering treatments was chosen to possibly circumvent the difficulties of sheet metal fabrication to produce small, seamless thrust chambers. Author

18 MATERIALS, METALLIC

Includes: cermets; mechanical and physical properties of alloys and metals; and metallurgy.

For related information see: 07 Chemistry; 17 Machine Elements and Processes; 19 Materials, Non-metallic; 33 Stresses and Loads; and 34 Structural Design.

N63-10579 Joint Publications Research Service, Washington, D.C.
SOVIET STUDIES IN POWDER METALLURGY
V. F. Funke et al Nov. 20, 1962 60 p 65 refs Transl. of several articles from the book "Issledeovaniya po Zharoprochnym Splavam (Research on Refractory Alloys)", v. 8, 1962 p 88-126 Moscow, USSR Acad. of Sci. Press
(JPRS-16269) OTS: $5.60

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1. THE EFFECT OF ALLOYING ON THE STRUCTURE AND PROPERTIES OF POWDER-METAL HARD ALLOYS OF TUNGSTEN CARBIDE AND COBALT V. F. Funke, V. I. Tumanov, Z. S. Trukhanova p 88-95 14 refs
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3. AN INVESTIGATION OF THE PRINCIPLES IN VIBRATION PRESSING OF POWDER METAL MATERIALS N. S. Gorbunev, I. G. Shatalova, V. I. Likhtman, and P. A. Rebinder p 103-110 5 refs
4. CERTAIN PROBLEMS IN THE THEORY OF THE THERMAL SHOCK RESISTANCE OF POWDER METAL MATERIALS M. Yu. Bal'shin, and V. I. Likhtman p 110-116 6 refs 116 6 refs
5. VISCOUS FLOW IN THE SINTERING OF POWDERS BY HOT PRESSING M. S. Keval'chenko and G. V. Samsonov p 116-126 22 refs

N63-10623 Joint Publications Research Service, Washington, D.C.
DETERMINATION OF THE SPECIFIC AREA OF POWDERS IN THE PRODUCTION OF HARD ALLOYS
B. V. Deryagin, V. N. Yermin et al Nov. 13, 1962 11 p 8 refs Transl. from Tsvetnye Metal. (Moscow), no. 11, Nov. 1959 p 55-60
(JPRS-16167) OTS: $1.60

The following methods—nitrogen absorption, the Carman, the Deryagin, and microscopic examination—were evaluated for measuring the specific area of powders used in the production of hard alloys. The nitrogen adsorption method, although it has sufficient accuracy, cannot be widely applied in the determination of the specific area of powders because of the labor involved and the complex apparatus required. Methods and equipment, based on air filtration at atmospheric pressure and using the Carman formula, yield inaccurate results and very low values of the specific area of powders of average and high degree of dispersion. The most promising method for the determination of the specific area of powders appears to be the Deryagin method of measuring the resistance of filtration of electrically neutral air. This method and the equipment based on it permit the rapid and sufficiently accurate determination of the external specific area of highly dispersed powders of the hard alloys and permit the calculation of the mean diameter of the particles, which is extremely important in the production of the hard alloy powders. J.R.C.

N63-10664 Southern Research Inst., Birmingham, Ala.
AN INVESTIGATION OF THE CRACK-PROPAGATION RESISTANCE OF HIGH-STRENGTH ALLOYS AND HEAT-RESISTANT ALLOYS Summary Technical Report, 23 December 1960 through 23 October 1962
J. D. Morrison, P. C. Jenkins, and J. R. Kattus Nov. 21, 1962 107 p 11 refs
(Contract NOw 61-0392-d)

The crack-propagation resistance of superalloy and refractory-metal sheet materials was determined and certain aspects of the elevated-temperature mechanical behavior of high-strength low-alloy steels were investigated. Sheet specimens containing central transverse fatigue cracks were used in the experimental work. An evaluation was made of the compliance gage for the determination of critical crack length. It was found that, by means of this device, critical crack length can be reproducibly measured in crack-propagation tests over a wide temperature range. Author

N63-10704 Thompson Ramo Wooldridge, Inc., Inglewood, Calif.
INVESTIGATION OF WELDING OF COMMERCIAL COLUMBIUM ALLOYS Final Report [16 Jan. 1961-15 Jan. 1962]
J. M. Gerken and J. M. Faulkner Wright-Patterson AFB, Ohio, Directorate of Materials and Processes, May 1962 148 p 20 refs
(Contract AF 33(616)-7796)
(ASD-TDR-62-292)

An investigation was made of the welding characteristics of three commercial columbium base alloys, FS82, D31, and F48. Tungsten inert gas, electron beam, spot, and flash butt welding methods were included in this investigation. The effect of the welding variables travel speed, shielding gas composition and purity, filler metal additions, preheat and post heat were studied. Thermal cycles were measured in the fusion zone and heat-affected zone of TIG welds to help explain mechanical properties and microstructure on the basis of physical metallurgy of each alloy. The effect of welding on all alloys was to increase the ductile to brittle transition temperature. The electron beam welding process consistently produced more ductile welds than the TIG process. Author

N63-10743 Michigan U., Ann Arbor
WIDE-TEMPERATURE-RANGE SPRINGS [Final] Technical Report [Feb. 1, 1959-Sept. 30, 1961]

H. Gascoigne, J. H. Enns, P. Kessel, and J. Ormondroyd Wright-Patterson AFB, Ohio, Directorate of Materials and Processes, May 1962 104 p 6 refs
(Contract AF 33(616)-6284)
(ASD-TR-61-566)

Bimetallic spring systems of 40% nickel-60% iron alloy combined with Inconel X and type 304 stainless steel exhibit characteristics suitable for applications from −65° F to 600° F. In this range the spring constant is held within ±0.25%. The general theory of bimetallic, temperature-independent helical coil and Belleville type springs is presented. The bimetallic systems tested show that a temperature-independent spring is feasible although working stresses must be maintained at relatively low levels. Author

N63-10745 Directorate of Materials and Processes, Aeronautical Systems Div., Wright-Patterson AFB, Ohio
MATERIALS CENTRAL-ASM METALLURGICAL EDUCATIONAL LECTURES [Final] Report
M. G. Fontana, A. M. Hall, Tung Liu, B. D. McConnell, and W. Payne May 1962 104 p 21 refs
(ASD-TDR-62-396)

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2. PROBLEMS IN USING METALLIC MATERIALS AT ELEVATED TEMPERATURES A. M. Hall (Battelle Memorial Inst.) p 13-30
3. MECHANICAL WEAR AND LUBRICATION Tung Liu and B. D. McConnell p 31-51 6 refs
4. SERVICE FAILURE ANALYSIS INVOLVING BRITTLE CRACKING MECHANISMS Lt. W. F. Payne p 53-102 15 refs

N63-10747 Battelle Memorial Inst., Columbus, Ohio
CLADDING UO_2 WITH BERYLLIUM BY GAS-PRESSURE BONDING
Stan L. Paprocki, Edwin S. Hodge, Hugh D. Hanes, James H. Peterson, and Glenn R. Goetsch Nov. 13, 1962 19 p 6 refs
(Contract W-7405-eng-92)
(BMI-1602) OTS: $0.50

Contamination-free beryllium-to-beryllium bonds were achieved by gas-pressure bonding at 1550° F to 1650° F for 4 hrs. at 10,000 psi. Bonds produced with grit-blasted surfaces exhibited up to 50 percent grain growth across the interface while those produced by shapering showed less grain growth. Although all of the beryllium-clad UO_2 fuel elements prepared possessed cracks in the cladding, the feasibility of this materials combination was proven by the bonds obtained between all of the beryllium components. The cracks appeared to be a result of reaction with the spacer material used in the bonding container rather than because of the inherent properties of beryllium or any of the fabricating procedures. Author

N63-10750 Carnegie Inst. of Tech. Metals Research Labs., Pittsburgh, Pa.
MECHANISM OF EVAPORATION OF METAL CRYSTALS Final Report
W. H. Robinson et al Sept. 10, 1962 66 p 47 refs
(Contract AF 49(638)-551)

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1. DISLOCATION CONFIGURATIONS IN DEFORMED SILVER SINGLE CRYSTALS H. J. Levinstein and W. H. Robinson p 1-32 18 refs To be presented at an intern. conf. on The Relations Between the Structure and the Mechanical Properties of Metals, National Physical Lab., Teddington, Gt. Brit., Jan. 7-9, 1963
2. TECHNIQUES FOR THE DIRECT OBSERVATION OF DISLOCATIONS IN SILVER SINGLE CRYSTALS p 33-35 3 refs
3. THERMAL ETCH PITS AT DISLOCATIONS IN LITHIUM FLUORIDE T. Ejima, J. P. Hirth, and W. H. Robinson p 36-63 26 refs

N63-10756 Directorate of Materials and Processes, Aeronautical Systems Div., Wright-Patterson AFB, Ohio
A STUDY OF QUENCH HARDENING IN PLATINUM AND GOLD Technical Documentary Report [Dec. 1960-Jan. 1961]
Harold Louis Gegel (M. S. Thesis - Ohio State U.) May 1962 58 p 56 refs
(ASD-TDR-62-329)

Results of this program have shown that vacancy complexes form during the quenching period when the average quenching speed is less than 10^{3}° C/second. The binding energy for divacancies in gold was estimated to be approximately 0.28 ev. The influence of increased quenching speeds is to increase the temperature recovery range for isochronal recovery. Similarly, fast quenching rates caused an incubation period in the isothermal aging experiments for gold. Two distinct hardening mechanisms exist for platinum and gold when the values of the activation energy for recovery are taken into account. The hardening mechanism for gold is thought to be due to the interaction of dislocations with extended sessile dislocations, and the hardening mechanism for platinum is thought to be due to the interaction of dislocations with dislocation loops. This model has been extended to other f.c.c. metals. Author

N63-10792 Solar, San Diego, Calif.
DIFFUSION BONDING OF REFRACTORY METALS Interim Technical Documentary Progress Report 1, 29 June-28 Sept. 1962
A. G. Metcalfe and T. B. Lindemer Oct. 1, 1962 110 p 134 refs
(Contract AF 33(657)-8789)
(RDR 1322-1)

This report summarizes the literature on diffusion bonding, analyzes the available information, and proposes the evaluation of certain new concepts for possible addition to the program. The literature survey has confirmed the high potential available by use of diffusion bonding for refractory metals. Author

N63-10921 Naval Research Lab., Washington, D. C.
EFFECT OF ENVIRONMENT ON THE STRENGTH OF METALS
M. R. Achter and P. Shahinian *In* Soc. of Aerospace Mater. and Process Engr. National Symp. on Effects of Space Environment on Materials, St. Louis, May 7, 8, and 9, 1962 23 p 26 refs (See N63-10912 02-01)

As a result of the temperature and stress sensitivity of atmospheric effect, metals at low temperature and high stress are stronger in vacuum or inert gas than in a reactive environment, while at high temperature and low stress there is a reversal and they are stronger in the reactive environment. A mechanism is proposed to explain this reversal in the environmental effect in terms of two competing processes. Surface adsorption lowers the work required to initiate and propagate a crack, while oxide and nitride formation harden and strengthen the metal. To demonstrate the operation of these effects the results of tensile, creep-rupture, and fatigue investigations from room temperature to 1900°F are described and explained by the proposed mechanism. Author

N63-10963 Avco Corp. Research and Advanced Development Div., Wilmington, Mass.
SOME EFFECTS OF TUNGSTEN POWDERS ON PLASMA SPRAYED AND SINTERED STRUCTURES
Paul L. Burnett and Gerald A. Jensen [1962] 10 p Presented at the ASD-NASA Refractory Composites Working Group Meeting, Dayton, Ohio, June 16-19, 1962

The effects of different types and sizes of tungsten powders on plasma sprayed structures before and after sintering are discussed.

Powders from two manufacturers have been tested for the particle size distribution before spraying, and for density measurements and microscopic structure after spraying and sintering. The density (% of theoretical) varied from 81.4% to 82.8% on the sprayed structure and from 86.3% to 95.0% on the structures sintered at 2000° C. These results indicate that in order to make real progress in the application of plasma sprayed and sintered tungsten to engineering structures, standardized methods of production and materials classification must be achieved. R.C.M.

N63-10964 Martin Co., Denver, Colo.
THE EVALUATION OF PROTECTIVE COATINGS ON COLUMBIUM ALLOY SHEET MATERIAL
K. R. Agricola [1962] 21 p Presented at the ASD-NASA Refractory Composites Working Group Meeting, Dayton, Ohio, June 16-19, 1962

An evaluation is made of protective coatings on columbium alloy sheet materials. Simulated junctions have been exposed to severe test conditions for several cyclic exposures at temperatures to 2700° F without severe oxidation of faying surfaces. Discussions with coating developers have indicated that by pack modifications or cycle revisions conditions conducive to greater diffusion rates and thus improved penetration can be achieved. This method of fabrication and subsequent protection would greatly facilitate component assembly and reduce possible damage during handling and processing. P.F.E.

N63-10966 Chromalloy Corp., West Nyack, N. Y.
ACTIVITIES OF CHROMALLOY CORPORATION IN THE DEVELOPMENT OF COATINGS FOR REFRACTORY METALS
[1962] 11 p Presented at the ASD-NASA Refractory Composites Working Group Meeting, Dayton, Ohio, June 16-19, 1962

Commercially available protective-coating materials for molybdenum alloys are discussed. These materials (W-2 and W-3) contain a silicide base and are applied by pack cementation. The W-2 pack compound contains 83% Al_2O_3, 6% Cr, 11% Si, and ¼ % NH_4I. Oxidation test data on W-3, an improved outgrowth of W-2, show an average protection time of 812 hours at 2500° F and 170 minutes at 3000° F. R.C.M.

N63-10969 Bureau of Mines, Washington, D. C.
AUTORADIOGRAPHY OF CARBON AND SULFUR IN TITANIUM STEELS
A[ndrew] A. Cochran and J. W. Jensen 1962 21 p 11 refs
(BM-RI-6122)

Methods of preparing small heats of steel containing radioisotopes were developed, and the techniques of stripping film autoradiography were used to detect and study the carbide and sulfide phases in titanium-bearing steels. Metallography had revealed areas of titanium sulfide and ferrite or pearlite adjacent to areas of titanium carbide and ferrite, and unidentified, irregular phases at the boundaries between these two areas. Sulfur 35 was used to determine the extent of the titanium sulfide inclusions, and carbon 14 was used to delineate the titanium carbide phase. Individual radioactive areas were located with a resolution of approximately 10 microns. A general background exposure that was not correlated with microscopically visible phases was observed in the carbon 14 autoradiographs. The evidence from both sulfur 35 autoradiographs and carbon 14 autoradiographs indicated that the unidentified inclusions were sulfides rather than carbides. Author

N63-10977 Joint Publications Research Service, Washington, D.C.
THE STRENGTH OF FINE METALLIC THREADS
V. N. Geminov and I. M. Kop'yev Dec. 7, 1962 11 p 4 refs
Transl. from Tr. Inst. Met. im. A. A. Baikova, Akad. Nauk SSSR (Moscow), no. 10, 1962 p 202-208
(JPRS-16567) OTS: $1.60

The mechanisms causing fracture in metallic whiskers are studied to develop a static strength hypothesis. Starting with the assumption that fracture occurs by the growth of dislocations, the role of surface energy in overcoming the plastic deformation due to shear is calculated. The shear resistance due to increased surface energy is shown to be negligible. The Frank-Read source and the Taylor grid are also shown to offer insufficient shear resistance to account for high strength in metallic whiskers. The negation of these resistance mechanisms points out the static nature of the strength of whiskers. From this hypothesis the probability of fracture of a whisker under a given tension can be determined. R.C.M.

N63-10983 Joint Publications Research Service, Washington, D.C.
PROBLEMS ON THE THEORY OF THE PROCESS OF PRESSING METAL POWDERS AND THEIR MIXTURES
G. M. Zhdanovich Dec. 7, 1962 102 p 18 refs Transl. of the booklet "Nekotoryye Voprosy Teorii Protsessa Pressovaniya Metallicheskikh Poroshkov i ikh Smessy", Minsk, Belorussian Polytech. Inst. im. I. V. Stalin, 1960 98 p
(JPRS-16573) OTS: $9.10

A theory is presented for the process of compacting metal powders and formulas are developed for computing the main quantitative phenomena of the process. Formulas are given for the following: relationship between the density of compacted powders and the pressure of compaction; coefficient of external friction; the work of compaction, external friction, and deformation; and the elastic deformation as a function of pressure and density. A high degree of accuracy is shown for these formulas by comparision with experimental data. R. C. M.

N63-10984 Joint Publications Research Service, Washington, D. C.
INVESTIGATION OF THE MICROSTRUCTURE OF CHROMIUM
M. P. Matveyeva Dec. 10, 1962 12 p 9 refs Transl. from Tr. Inst. Met. im. A. A. Baikova, Akad. Nauk SSSR (Moscow), no. 10, 1962 p 181-187
(JPRS-16591) OTS: $1.60

Studies of the mechanical properties of chromium as related to the structural factors are reported. The microstructure of chromium was studied by electrochemical etching and electron microscope methods. Factors which modify the microstructure of chromium were considered including plastic deformation, heat treatment, and the addition of various compounds which either act directly on the chromium or on the impurities already present. Preliminary results indicate that the application of plastic deformation with subsequent heat treatment may affect the microstructure and lead to a lowering of the threshold of brittleness. M.P.G.

N63-10986 National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
DETERIORATION OF CALCIA-STABILIZED ZIRCONIA
John D. Buckley (M.S. Thesis - Clemson Agr. Coll., June 1961) Washington, NASA, Dec. 1962 23 p 6 refs
(NASA TN D-1595) OTS: $0.75

The possible causes of the physical breakdown and friability exhibited by fused stabilized zirconia refractories when subjected to severe cyclic heat treatment in the heat exchangers of ceramic-heated blowdown jets were investigated. The crystal structure and the calcia content of unused stabilized zirconia refractory and of the deteriorated material were analyzed by X-radiation. Results of the analysis showed that the deteriorated material was definitely less stable (contained less cubic zirconia) than unused stabilized zirconia. Author

19 MATERIALS, NON-METALLIC

Includes: mechanical and physical properties of non-metals (e.g., plastics).

For related information see: 07 Chemistry; 17 Machine Elements and Processes; 18 Materials, Metallic; 33 Stresses and Loads; and 34 Structural Design.

N63-10622 Joint Publications Research Service, Washington, D. C.
A REFRACTORY BASED ON BORON NITRIDE
G. V. Samsonov, Yu. N. Semenov, and P. Ya. Borodulin Nov. 13, 1962 8 p 8 refs Transl. from Ogneupory (Moscow), no. 7, 1962 p 332-336
(JPRS-16158) OTS: $1.10

The technology of the reaction sintering of a new refractory consisting of 82%-83% boron nitride and 17%-18% graphite has been developed. This refractory possesses high resistivity up to 1500°-1600°, a low thermal expansion coefficient, a moderate rate of evaporation in a vacuum, satisfactory strength and machineability, and also excellent reistance to the action of molten cryolite-aluminum, molten borates, chlorides, as well as the molten silicides and alloys of boron with silicon (at temperatures of 900°-2000°). Author

N63-10625 National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
INITIAL WEIGHT LOSS OF PLASTICS IN A VACUUM AT TEMPERATURES FROM 80° TO 500° F
Hermilo R. Gloria, W. James Stewart, and Raymond C. Savin Washington, NASA, Dec. 1962 20 p 13 refs
(NASA-TN-D-1329) OTS: $0.50

Initial rates of weight loss are determined for five plastic materials at pressures from 3×10^{-7} to 3×10^{-6} mm Hg and at temperatures ranging from 80° to 500° F. The materials tested include two thermoplastics, polytetrafluoroethylene and polycarbonate; two types of reinforced phenolics; and a relatively pure epoxy resin. The effect of material thickness on initial rate of weight loss for all the test materials is also presented. Author

N63-10630 National Carbon Co., Parma, Ohio
RESEARCH AND DEVELOPMENT ON ADVANCED GRAPHITE MATERIALS. VOLUME III. ELECTRON SPIN RESONANCE IN POLYCRYSTALLINE GRAPHITE [Interim Report]
L. S. Singer and G. Wagoner Wright-Patterson AFB, Ohio, Directorate of Materials and Processes, June 1962 19 p 22 refs For Vol. III, see N62-16898 17-18
(Contract AF 33(616)-6915)
(WADD-TR-61-72, Vol. VIII)

The electron spin resonance of polycrystalline graphite is shown to be due to charge carriers, as for single crystals. For lampblack-base graphite, the variation in g-value with temperature agrees approximately with that for single crystal graphite if it is assumed that the spins effectively average out the anisotropic interactions by rapid intercrystallite diffusion. The magnitude and temperature dependence of the spin susceptibility are found to be in excellent agreement with McClure's theoretical predictions for the charge carriers in perfect graphite. Complications of measuring these materials are discussed, including effects of skin depth and microwave heating and the dependence upon crystalline size and sample purity. It is found that two types of impurities can affect the resonance; those which become ionized and shift the Fermi level, and large un-ionized atoms which do not shift the Fermi level but act as efficient scattering centers for shortening the spin-lattice relaxation time. Author

N63-10649 Minnesota U., Minneapolis
BIBLIOGRAPHY AND TABULATION OF DAMPING PROPERTIES OF NON-METALLIC MATERIALS [Final Report, June 1957 to Sept. 1960]
Sun Hwan Chi Wright-Patterson AFB, Ohio, Directorate of Materials and Processes, Sept. 1962 154 p 200 refs
(Contract AF 33(657)-7453)
(WADD-TR-60-540)

This bibliography was compiled as an aid for those people interested in damping research and related fields. It contains a nearly complete list of references on the damping properties of nonmetallic materials for the period from 1929 to 1959, together with an index of nomenclature, units, and test methods. Tabulations of the in-phase and out-of-phase components of Young's modulus and the shear modulus for the various materials are also shown. Graphical representations of experimental data indicate the loss factor values for different materials. These values of the loss factor are compared to those of the representative structural metals. Author

N63-10714 National Carbon Co., Parma, Ohio
RESEARCH AND DEVELOPMENT ON ADVANCED GRAPHITE MATERIALS. VOLUME XI—CHARACTERIZATION OF BINDERS USED IN THE FABRICATION OF GRAPHITE BODIES Technical Documentary Report [Jan. 1-Dec. 31, 1961]
E. de Ruiter, A. Halleux, V. Sandor, and H. Tschamler (Union Carbide European Research Associates, Brussels) Wright-Patterson AFB, Ohio, Directorate of Materials and Processes, Sept. 1962 30 p 18 refs
(Contract AF 33(616)-6915)
(WADD-TR-61-72, Vol. XI)

A series of chemical and physical methods, previously developed for use in the study of the constitution of coals, has been applied to the definition of structural parameters for thirteen tar and pitch samples which have a wide range of properties and which are of interest in the fabrication of graphite bodies. Information obtained on the molecular size and composition indicates the presence of polycyclic compounds with a high degree of aromaticity. Evidence also points to the importance of large aromatic clusters. Author

N63-10922 Bell Aerosystems Co., Buffalo, N. Y.
THE EFFECTS OF HIGH VACUUM AND RADIATION ON POLYMERIC MATERIALS
Norman E. Wohl and John V. Robinson *In* Soc. of Aerospace Mater. and Process Engr. National Symp. on Effects of Space Environment on Materials, St. Louis, May 7, 8, and 9, 1962 28 p 6 refs (See N63-10912 02-01)

Data on the influence of combined radiation, heat and high vacuum on the physical properties of organic materials that might be used in space vehicles on equipment is deficient. This paper describes experimental studies that were conducted to determine the effects of heat, low pressure, and radiation on plastics and elastomeric materials. Author

N63-10923 Aeronautical Systems Div. Materials Central, Wright-Patterson AFB, Ohio
FABRICATION OF FOAMED POLYURETHANE STRUCTURES IN A SPACE ENVIRONMENT
Sidney Allinikov and Seymour Schwartz (Hughes Aircraft Co.) *In* Soc. of Aerospace Mater. and Process Engr. National Symp. on Effects of Space Environment on Materials, St. Louis, May 7, 8, and 9, 1962 21 p 5 refs (See N63-10912 02-01)

Several approaches to solution of the difficulties associated with producing chemically foamed-in-place polyurethanes at reduced atmospheric pressures are discussed. Advantages and drawbacks of the various polyurethane foam reactant systems explored are referenced. The preliminary development of a one-part solid-reactant polyurethane-foam system and its implications are presented. Suggested applications for polyurethane foam in an aerospace environment are submitted. Author

N63-10924 Minnesota Mining and Mfg. Co., St. Paul
FLUOROCARBON PLASTICS UNDER THE INFLUENCE OF UNUSUAL ENVIRONMENTAL CONDITIONS
Robert P. Bringer *In* Soc. of Aerospace Mater. and Process Engr. National Symp. on Effects of Space Environment on Materials, St. Louis, May 7, 8, and 9, 1962 22 p 14 refs (See N63-10912 02-01)

The fluorocarbon plastics, already known for their chemical inertness and temperature resistance, are reviewed in light of available data taken under exposure to unusual conditions. A brief description is given of the chemical nature and general properties of the commercially important fluorocarbon plastics. The effects of high and low (cryogenic) temperatures, exposure to liquid oxygen, γ- and X-irradiation in air and in vacuum, ultraviolet radiation, and vacuum exposure are explored. Author

N63-10925 Aerospace Corp., El Segundo, Calif.
THE EFFECT OF SPACE ENVIRONMENT ON REINFORCED PLASTICS
Leo E. Gatzek and Lionel Isenberg (Aerojet-General Corp.) *In* Soc. of Aerospace Mater. and Process Engr. National Symp. on Effects of Space Environment on Materials, St. Louis, May 7, 8, and 9, 1962 46 p 69 refs (See N63-10912 02-01)

The role of reinforced-plastic composite systems in future aerospace applications is reviewed with particular emphasis on space structures. Examples of unique plastic-molding, filament-winding, and laminating techniques as applied to aerospace structures are presented. Effects of the aerospace environment on reinforced plastics and probable ways of improving these materials commensurate with future requirements are discussed. The outlined information is used to establish a factual basis for predicting the future space applications of reinforced plastic material systems within realistic limits. Author

N63-10926 Minnesota Mining and Mfg. Co., St. Paul
THE EFFECT OF GAMMA RADIATION OF STRUCTURAL ADHESIVE JOINTS
R. M. Mc Curdy and G. M. Rambosek *In* Soc. of Aerospace Mater. and Process Engr. National Symp. on Effects of Space Environment on Materials, St. Louis, May 7, 8, and 9, 1962 12 p (See N63-10912 02-01)

The effect of gamma radiation on the performance of several structural adhesive bonds was measured. It was concluded that: (1) nitrile-phenolic adhesives are more resistant to radiation damage than epoxy-based adhesives, (2) the peel strength of adhesives deteriorates more rapidly than other properties, and (3) thick adhesive layers retain useful strength better than thin glue lines. Author

20 MATHEMATICS

Includes: calculation methods and theory; computers; data processing; and numerical analysis.

For related information see: 08 Communications; 09 Electronics; 10 Facilities; and 22 Navigation and Guidance.

N63-10582 Joint Publications Research Service, Washington, D. C.
A PROBABILITY PROBLEM OF OPTIMAL CONTROL
A. N. Kolmogorov, Ye. F. Mishchenko, and L. S. Pontryagin (Mathematical Inst. im. V. A. Steklov) Nov. 9, 1962 8 p 2 refs Transl. from Doklady Akad. Nauk SSSR (Moscow), v. 145, no. 5, 1962 p 993-995
(JPRS-16124) OTS: $1.10

Kolmogorov's formula is proved and its accuracy is compared to the approximate formula proposed by Mishchenko and Pontryagin. The probability density of Markov's process in an n-dimensional Euclidian space is found by both formulas and found to be the same for the case of a specially selected small ellipsoid. R.C.M.

N63-10598 RAND Corp., Santa Monica, Calif.
FLOWS IN NETWORKS
L. R. Ford, Jr. and D. R. Fulkerson Aug. 1962 213 p 126 refs
(Contract AF 49(638)-700; Proj. RAND)
(R-375-PR)

This book on flows in networks covers the following: static maximal flow; feasibility theorems and combinatorial applications; minimal cost flow problems; and multiterminal maximal flows. J.R.C.

N63-10603 Northwestern Technological Inst., Evanston, Ill.
CRITICAL PATH ANALYSES VIA CHANCE CONSTRAINED AND STOCHASTIC PROGRAMMING
W. W. Cooper, G. L. Thompson (Carnegie Inst. of Tech.), and A. Charnes July 1962 21 p 11 refs
(Contract Nonr-1228(10) and Nonr-760(01))
(ONR Res. Memo-62)

A chance constrained programing formulation is presented for the distribution of optimum functional values that are of a probabilistic nature. Project scheduling, of the kind that is usually associated with critical path analysis, is included. A pessimistic time, a normal time, and an optimistic time are assumed for each task. It is assumed that a particular distribution of times applies to each branch of the project network, and an attempt is made to characterize the resulting distribution of total project completion times. This is done by a minimizing principle which implicitly carries with it a characterization of the critical paths that are associated with each set of time realizations that the distributions admit for each branch of the network. The main focus is on the statistical distributions of the project completion (and subcompletion) times. J.R.C.

N63-10604 Northwestern Technological Inst., Evanston, Ill.
OPTIMIZING ENGINEERING DESIGNS UNDER INEQUALITY CONSTRAINTS
W. W. Cooper (Carnegie Inst. of Tech.) and A. Charnes Aug. 1962 10 p 7 refs
(Contracts Nonr-1228(10) and Nonr-760(01))
(ONR Res. Memo-64)

This paper extends the Duffin-Zenner optimal engineering formulations in order to permit dealing with the constraints that are often imposed on the design choices, using available computer theory and computer codes. These formulations also provide a basis for further developments in computational methods and theory which will be specially oriented to design engineering problems. Constraint considerations are reduced to separable convex functionals with the result that direct contact is established with the computing routines of linear programing by recourse to suitable piecewise linear approximations. Where a duality exists, methods of iterative calculation are suggested that are based on the tactic of first approximating the optimum as rapidly as possible and then undertaking further refinements. This idea can be built up into a computational method with a reordering at each stage based on the gradient at that stage and with possible limitations on the admissible distances for successive values. M.P.G.

N63-10607 California U., Berkeley
PRESSURE AS A FUNCTION OF DISTANCE: II Scientific Report No. 4
F. N. David and M. K. Gupta Oct. 31, 1962 18 p
(Contract AF 19(604)-8051)
(AFCRL-62-1012)

The data of experience give the correlation in the pressures recorded at pairs of stations situated at varying distances apart. Starting with an arbitrarily chosen stochastic model, a model so chosen approximately to describe the observed effects, a formula for the correlation for any pair of stations is deduced. The parameters in the model have been guessed so that the cross sections of the correlation-distance surface have the same kind of pattern as those observed in the observed data, and the theoretical correlations between the pressures at several pairs of stations have been calculated.

The agreement, for stations reasonably close together, between the observed correlations and those deduced from the model, is good enough for accurate estimation (instead of guesswork) of the parameters in the model to be worthwhile carrying out. The results of calculations with the model, using accurately estimated parameters, will indicate possible desirable modifications. Author

N63-10613 Argonne National Laboratory, Ill.
ENGINEERING APPLICATIONS OF ANALOG COMPUTERS
Lawrence T. Bryant, Louis C. Just, Marion J. Janicke, and Alan L. Winiecki Oct. 1962 (Rev.) 53 p 17 refs
(Contract W-31-109-eng-38)
(ANL-6319 Rev.)

Analog computing techniques are used to solve the nonlinear differential equations representing the following problems: deceleration of a reactor control rod; pressure variations through a packed bed; reactor kinetics over many decades with thermal feedback; a vibrating system with two degrees of freedom; temperature distribution in a radiating fin; temperature distribution in an infinite slab considering variable thermal properties; and iodine-xenon buildup in a reactor. J.R.C.

N63-10631 Joint Publications Research Service, Washington, D.C.
CYBERNETICS AND CONTROL THEORY
Yu. Ofman and Ya. Z. Tsypkin Nov. 23, 1962 19 p 4 refs Transl. of two articles from Doklady Akad. Nauk SSSR (Moscow), v. 145, no. 1, Jan. 1962 p 48-55
(JPRS-16303) OTS: $1.60

CONTENTS:
1. ON THE ALGORITHMIC COMPLEXITY OF DISCRETE FUNCTIONS Yu. Ofman p 1-10
2. OVER-ALL STABILITY OF NONLINEAR PULSED AUTOMATIC SYSTEMS Ya. Z. Tsypkin p 11-16 4 refs

N63-10638 Joint Publications Research Service, Washington, D.C.
TRANSLATIONS FROM DOPOVIDI AKADEMII NAUK [UKRAINSKOI] RSR [KIEV] (BULLETIN OF THE ACADEMY OF SCIENCES UkSSR), NO. 7, 1962
V. N. Romanenko, G. E. Pukhov, and K. L. Yushchenko Nov. 30, 1962 22 p 9 refs Transl. of five articles from p 863-873, 970-971, and 974-975
(JPRS-16446) OTS: $2.60

CONTENTS:
1. ON A PROBLEM OF STABILIZATION V. N. Romanenko p 1-6 1 ref
2. QUASI-ANALOGUE ELECTRONIC COMPUTER FOR SOLUTION OF GENERAL PROBLEMS OF THE MATHEMATICAL PROGRAMMING G. E. Pukhov p 7-10 4 refs
3. LEVELS AND STYLES OF ADDRESS LANGUAGE AND THE PROBLEM OF PROGRAMMING AUTOMATION K. L. Yushchenko p 11-14 4 refs
4. THE STATE AND THE CYBERNETICS RESEARCH PERSPECTIVES IN THE UKRAINE AND ORGANIZATION OF THE CYBERNETICS INSTITUTE OF THE ACADEMY OF SCIENCES UKRAINIAN SSR p 15-17
5. INCREASING SCIENTIFIC RESEARCH WORK IN THE FIELD OF ELECTRIFICATION AND AUTOMATION OF PRODUCTION PROCESSES p 18-19

N63-10657 Oak Ridge National Lab., Tenn.
COMPUTER PROGRAMS USING ZONAL HARMONICS FOR MAGNETIC PROPERTIES OF CURRENT SYSTEMS WITH SPECIAL REFERENCE TO THE IBM 7090
M. W. Garrett Dec. 4, 1962 46 p 8 refs
(Contract W-7405-eng-26)
(ORNL-3318) OTS: $1.25

This report discusses the magnetic vector and scalar potentials, magnetic field components and their derivatives, and flux linkage for single current systems, and the mutual inductance, forces, and torques between two such systems, whose axes are coplanar but not necessarily coincident. Each system may include a combination of coaxial loops, cylindrical or plane annular current sheets, and cylindrical coils of rectangular section. Working equations are listed, following an outline of theory in a form that has considerable generality but is at the same time ideally suited to precise calculation. A discussion of errors and of means for reducing them leads to specific suggestions for use of the method with any programmed computer. An existing comprehensive program for the IBM 7090 is described in detail. Alternative programs that have been used are compared with the method of zonal harmonics, but they are slower by more than a factor of 10 when large numbers of field calculations must be made on a complex current system. Author

N63-10694 Brown Engineering Co., Inc., Huntsville, Ala.
HYPERSONIC HEATING RATES
H. Tracy Jackson, Jr., and Perry F. Mc Donald Oct. 2, 1962 32 p 14 refs
(Contract DA-01-009-ORD-1019)
(Tech. Note R-13)

This report gives the detailed derivation and assumptions which describe the aerodynamic-heating history along an axisymmetric vehicle reentering the atmosphere at hypersonic velocities. Solutions are given for blunt bodies as well as conical shapes. Both the laminar and turbulent form of the heating equations have been successfully programed on an IBM 1401 and 7090 computer. Author

N63-10695 Brown Engineering Co., Inc., Huntsville, Ala.
A TABLE OF PLANCK'S RADIATION EQUATION INTEGRATED
H. Tracy Jackson, Jr. Oct. 5, 1962 20 p 2 refs
(Contract DA-01-009-ORD-1019)
(Tech. Note R-15)

This report gives tabulated values of Planck's black-body-radiation equation integrated from 0 to wavelength (λ) in normalized form. Author

N63-10696 Brown Engineering Co., Inc., Huntsville, Ala.
PROJECTED AREAS OF AXIALLY SYMMETRIC SURFACE SECTIONS FOR SEVERAL GEOMETRIC FIGURES
A. R. Phillips May 7, 1962 29 p
(Contract DA-01-009-ORD-1019)
(Tech. Note R-18)

Equations permitting the calculation of the projected areas of arbitrary, axially symmetric surface bands are derived for the cone, sphere section, and cylinder. The equations apply to viewing angles ranging from 0° to 90°, measured from the symmetry axes. Author

N63-10698 Brown Engineering Co., Inc., Huntsville, Ala.
FLARED-CONE PROJECTED AREAS
A. R. Phillips June 5, 1962 50 p
(Contract DA-01-009-ORD-1019)
(Tech. Note R-3)

This document presents formulas suitable for the calculation of the projected areas of arbitrary, axially symmetric surface sections for a flared-cone figure. The formulas apply to aspect angles ranging from 0° to 90°, measured from the symmetry axis. Derivations are included. Author

N63-10716 Illinois U., Urbana
MASS UNBALANCE IN A SIMPLIFIED AUTOSPIN SYSTEM Fourth Interim Technical Report
J. M. Doyle Jan. 1962 29 p
(Contract DA-11-022-506-ORD-3488)
(T&AM-206)

An autospin system, consisting of a two-part missile mounted on a common axis so that a slow spin can be imparted to the rocket motor by an internal angular impulse, is analyzed to determine the effect of mass unbalance on the trajectory. The equations of motion are linearized and the entire fuel cell is assumed to be discharged as a single rigid body. Author

N63-10719 Illinois U., Urbana
AN ANALYSIS OF THE MOTION OF MISSILES Final Report
M. Stippes Feb. 1962 10 p
(Contract DA-11-022-506-ORD-3488)
(T&AM-210)

This report describes investigations in a variety of areas associated with missile launching problems for aid in the design and development of optimum systems. Author

N63-10726 Brown Engineering Co., Inc., Huntsville, Ala.
A FORTRAN PROGRAM TO CALCULATE ATMOSPHERIC PROPERTIES
H. M. Minshew Oct. 1962 19 p 1 ref
(Tech. Note R-27)

Atmospheric property data up to 400,000 feet are fit with polynomials. The subroutine is written in FORTRAN II for the IBM 1410 Computer. Author

N63-10731 Sylvania Electric Products, Inc. Electronic Systems Div., Needham, Mass.
SUBMICROSECOND SIMULATION COMPUTER STUDY PROGRAM. PART II. PRELIMINARY DESIGN AND SYSTEM SYNTHESIS [Final] Technical Documentary Report [Nov. 1, 1961-Apr. 30, 1962]
Edward L. Perry, H. Kaufman, M. Stern, H. Ullman, F. MacNair, W. Dunnett, R. Taylor, and J. Nimmo Wright-Patterson AFB, Ohio Behavioral Sciences Lab., Oct. 1962 136 p 18 refs For Pt. I see N62-14915 13-19
(Contract AF 33(616)-8092)
(MRL-TDR-62-27(II)) OTS: $2.75

The results of a research program to determine the preliminary design and system configuration of a high-speed simulation computer are described. Bench tests and analytical study of circuits utilizing the Fairchild 2N709 transistor have shown that the propagation delay through the basic diode-transistor NAND logic circuit will be approximately 4 nanoseconds. The memory study and tests have supported the use of ferrite cores for the storage of bulk program data. These cores may be sensed nondestructively at a two-megacycle rate by means of a flux-direction sensing technique. A fast scratch-pad memory is provided to compensate for the characteristically slow writing rate (250 KC) associated with the nondestructive read-out memory. The computer described is designed to achieve a 0.75μs floating-point addition operation time using these circuits and memories. Author

N63-10755 Brown U. Div. of Applied Mathematics, Providence, R. I.
THEORY OF ELASTIC STABILITY AND POST-BUCKLING BEHAVIOUR
W. T. Koiter Oct. 1962 88 p 6 refs
(Contract Nonr-562(10))
(C11-80)

The basic concepts and theorems of tensor analysis are discussed and applied to problems of elastic stability and post-buckling behavior. This paper is intended as an appendix to a projected book on these problems and to encourage the application of tensor analysis by physicists and engineers. Both the theory of elasticity and the shell theory are discussed. R.C.M.

N63-10776 European Atomic Energy Community, Brussels (Belgium)
TERMIDOR—AN IBM 7090 FORTRAN CODE TO EVALUATE THE THERMAL NEUTRON SPECTRUM IN AN ORGEL TYPE FUEL ELEMENT
G. Rossi Joint Nuclear Research Center, Ispra Establishment (Italy), Reactor Physics Dept., Oct. 1962 16 p 2 refs
(EUR-105.e) Available from Belgian American Bank and Trust Co., N. Y., account No. 121.86: 30 Belg. Fr.

The general lines are presented of the simplified model adopted to evaluate the thermal neutron spectrum in an Orgel-type fuel element. The flow chart of the code and the input and output data of the subroutines, which contain directly utilizable results, are given. Author

N63-10777 European Atomic Energy Community, Brussels (Belgium)
DIFF—UN PROGRAMME FORTRAN 7090 POUR DÉTERMINER LES CONSTANTES DE DIFFUSION NEUTRONIQUE RELATIVES À UN CALCUL À SIX GROUPES [DIFF—A 7090 FORTRAN PROGRAM TO DETERMINE NEUTRON DIFFUSION CONSTANTS RELATING TO A SIX-GROUP CALCULATION]
C. Pleinevaux Joint Nuclear Research Center, Ispra Establishment (Italy), Reactor Physics Dept., Oct. 1962 33 p 7 refs In French; English summary
(EUR-106.f) Available from Belgian American Bank and Trust Co., N. Y., account No. 121.86: 30 Belg. Fr.

The DIFF program computes the neutron diffusion constants for any kind of mixture. These constants, which are directly suitable for the RASH program, are shown for a six-group calculation and for materials used in shielding calculations. Author

N63-10779 European Atomic Energy Community, Brussels (Belgium)
TABLE DES FONCTIONS INTEGRALES EXPONENTIELLES [TABLE OF THE EXPONENTIAL INTEGRAL FUNCTIONS]
C. Pleinevaux Joint Nuclear Research Center, Ispra Establishment (Italy), Reactor Physics Dept., Oct. 1962 115 p In French; English summary
(EUR-108.f) Available from Belgian American Bank and Trust Co., N. Y., account No. 121.86: 110 Belg. Fr.

This table contains the exponential integral functions of the three first-orders for values of the variable ranging from 0 to 40. The calculations were performed on the IBM 7090. Author

N63-10783 Princeton U. Plasma Physics Lab., N. J.
IDENTIFYING SPECTRAL LINES ON A COMPUTER
Harold Vandenburgh and Lanny Hoffman Aug. 1962 94 p 4 refs
(Contract AT(30-1)-1238)
(MATT-90)

Two programs have been written which allow a spectroscopist to dump most of the dull leg work off onto a digital computer. These programs separate spectral line identification into two parts: (1) conversion from comparator readings (distance) to wavelengths based on a known dispersion curve for the spectrograph, and, (2) correlation of observed lines and tabulated multiplets, in first, second, and third orders, listing these in a convenient form. Author

N63-10864 Los Alamos Scientific Lab., N. Mex.
DIGITAL PROGRAMS FOR PARA HYDROGEN PROPERTIES
O. A. Farmer Nov. 20, 1962 34 p 6 refs
(Contract W-7405-ENG-36)
(LAMS-2762) OTS: $0.75

Programs for computing parahydrogen properties from inputs of temperature and pressure have been written. The range is 20°

to 3000° K and 1 to 100 atm. The programs are written as closed FORTRAN subroutines to be used on the IBM 7090. The equations, references, graphs, and tabular values are included. Author

N63-10900 Radio Corp. of America. Aerospace Communications and Controls Div., Burlington, Mass.

THEORETICAL AND COMPUTER STUDY OF CONVOLUTIONAL CODES AND SEQUENTIAL DECODING Final Report

Walter R. Wadden, David M. Jones, and Julian Bussgang Sept. 1962 83 p 5 refs

(Contract AF 19(628)-436)

This report summarizes the study of sequential decoding for the binary symmetric channel. The program included the analytical and experimental evaluation of sequential decoding algorithms. The experimental investigation required extensive use of a general-purpose computer for simulation studies. The decoders are compared in terms of the complexity of the special-purpose computer required to implement each algorithm on the basis of a set probability of a decoding error rather than a set constraint length. Author

N63-10940 Brown Engineering Co., Inc., Huntsville, Ala.

A FORTRAN PROGRAM TO CALCULATE A BALLISTIC MISSILE TRAJECTORY FROM BURN OUT TO IMPACT

Charles F. Ostner Nov. 1962 45 p 3 refs

(Contract DA-01-009-ORD-1068)

(Tech. Note R-28)

This computer program computes a ballistic trajectory from burnout, or any point thereafter, to impact. It assumes point mass and a spherical earth. The program takes into account air resistance, the variation of the gravitational and centrifugal field with altitude, and earth's rotation. It uses a system of coordinates (X, Y, and Z) rigidly connected with the rotating earth. Author

N63-10952 National Aeronautics and Space Administration, Washington, D.C.

A LOGICAL NET MECHANIZATION FOR TIME-OPTIMAL REGULATION

Fred B. Smith, Jr. (Minneapolis-Honeywell Regulator Co.) Dec. 1962 35 p 3 refs

(NASA Contract NASr-27)

(NASA TN D-1678) OTS: $1.00

A technique is described for mechanizing relay controllers. A quantized phase space for the plant is mapped into two or more points by a collection of logic elements whose Boolean inputs are the quantized variables. If the switching surfaces are known explicitly, the logic (the mapping function) of the controller may be computed in a straightforward manner. If the surfaces are known only implicitly, the logic may be adjusted on a representative collection of particular values of the desired mapping function. Experimental results are presented for time-optimal control of third-order and fourth-order plants. Author

N63-10957 International Business Machines Corp. Federal Systems Div., Rockville, Md.

NASA PROJECT MERCURY: PROGRAM SYSTEM STANDARDS

NASA. Goddard Space Flight Center, Greenbelt, Md., May 1, 1962 (Rev.) 104 p

(NASA Contract NAS5-1376)

(MC-102) OTS: $9.10 ph, $3.32 mf

The programing standards developed for Project Mercury are discussed in terms of the Share Operating System (SOS), Share Compiler-Assembler-Translator (SCAT), and the mathematical standards. R.C.M.

N63-10976 Joint Publications Research Service, Washington, D.C.

AN ALGORITHM FOR SOLVING LARGE SYSTEMS OF NORMAL EQUATIONS BY MEANS OF MULTIGROUP METHOD ON AN ELECTRONIC COMPUTER

S. L. Khublarova Dec. 7, 1962 43 p 6 refs Transl. from Trudy Tsentral. Nauch.-Issledovatel. Inst. Geodezii, Aeros'yemki i Kartografii (Moscow), no. 147, 1962 p 17-33

(JPRS-16566) OTS: $4.60

An algorithm is formulated for solving large systems of normal equations by means of a multigroup method on an electronic computer. The algorithm permits adjustment of second-order triangulation networks in a first-class polygon filled by sections. The multigroup used permits the use of previous computations in annexing other networks. The algorithm developed ensures a severalfold reduction of numerical data read into the computer, a decrease in machine time spent in actual computations, and a significant reduction in the amount of writing and reading done by the computer. J.R.C.

N63-10994 Michigan U. Coll. of Engineering, Ann Arbor

EVALUATION OF MATRIX ELEMENTS IN CRYSTALLINE FIELD THEORY Technical Report

Sow Hsin Chen Oct. 1962 76 p 26 refs

(Contract AF 49(638)-987)

(Rept. 04275-1-T)

The weak-field scheme is used to evaluate the matrix elements in L-S coupling and diagonalize the free ion Hamiltonian plus the perturbation due to ligand field. This technique can be applied to the interpretation of optical and microwave absorption spectra of crystalline solids. Racah's method, which applies to the free atom case and group three elements, is used for evaluating all terms that appear in the Hamiltonian. This method combines tensor algebra with the method of constructing the wave function for equivalent electrons by using the vector-coupling formula and fractional-parentage coefficients. R.C.M.

21 METEOROLOGY

Includes: climatology; weather forecasting; lower atmosphere studies; and oceanography.

For related information see: 05 Astronomy and Astrophysics; 12 Geophysics; and 29 Space Sciences.

N63-10634 Army Electronics Research and Development Activity. Missile Meteorology Div., White Sands Missile Range, N. Mex.

WIND SHEAR IN THE JET STREAM AT WHITE SANDS MISSILE RANGE Technical Report

Manuel Armendariz, Emmit Fisher, and Juana Serna Nov. 1962 29 p 9 refs

(SELWS-M-13)

A discussion of wind shear in the jet stream over White Sands Missile Range, New Mexico, is presented. Wind data collected utilizing the GMD-1 system are used to calculate vectorial wind shear. The maximum jet wind speed could not be significantly correlated to the maximum wind shear for any particular observation. Mean vectorial wind shear and standard deviation for each thousand feet of height in the jet stream are included. Author

N63-10639 Joint Publications Research Service, Washington, D.C.

RECENT DEVELOPMENTS IN METEOROLOGY

Yeh Tu-Cheng Nov. 27, 1962 12 p Transl. from K'o Hsueh T'ung Pao (Peking), no. 2, Feb. 1962 p 28-33

(JPRS-16379) OTS: $1.60

The major meteorological achievements since the beginning of the International Geophysical Year are reviewed in terms of data obtained, new techniques, and new instruments. R.C.M.

N63-10660 Joint Publications Research Service, Washington, D. C.
UNSCREENING OF IMAGES FOR OPTIMUM VISUAL INFORMATION (LE DETRAMAGE DES IMAGES COMME PROCEDE D'UTILISATION OPTIMALE DES INFORMATIONS)
J. Surget and C. Veret (ONERA) Dec. 6, 1962 11 p 2 refs Transl. of a paper presented at the Sixth Annual Conf. of Agard Avionics Panel, Paris, July 1962
(JPRS-16539) OTS: $1.60

An optical system which makes it possible to reproduce an object may be considered as a filter of the spatial frequencies of the object. In this system, there is a specific plane in which the distribution of the luminous vibrations corresponds to the frequency spectrum of the object function. By placing suitable masks in this plane, it is possible to act selectively on the spatial frequencies so as to stress some of them in relation to others. Examples of the application of the technique are given for the unscreening of photographic prints, for the suppression of the scanning lines in television images, and for the unscreening of striograms taken through the perforated walls of a supersonic wind tunnel. Author

N63-10661 Joint Publications Research Service, Washington, D. C.
TRANSLATIONS FROM METEOROLOGIYA I GIDROLOGIYA [MOSCOW] (METEOROLOGY AND HYDROLOGY), NO. 9, SEPTEMBER 1962
N. A. Belinskiy, L. M. Rakipova, D. M. Sonechkin, and L. V. Klimenko Dec. 7, 1962 59 p 115 refs Transl. of eight articles from p 4-6, 28-36, and 58-64
(JPRS-16557) OTS: $5.60

CONTENTS:

1. GREAT PROSPECTS IN THE DEVELOPMENT OF METEOROLOGY, OCEANOGRAPHY, AND HYDROLOGY OF THE LAND N. A. Belinskiy p 1-6
2. CHANGES IN CLIMATE THROUGH CONTROL OF ARCTIC BASIN ICE L. M. Rakipova (Main Geograph. Obs., USSR) p 7-16 2 refs
3. INTERPRETATION OF TELEVISION IMAGES OF CLOUDINESS OBTAINED FROM ARTIFICIAL SATELLITES D. M. Sonechkin (Central Inst. of Prognosis, USSR) p 17-25 5 refs
4. ON ESTIMATING QUANTITITES OF TEMPERATURE ANOMALY L. V. Klimenko (Moscow State U.) p 26-32 5 refs
5. LITERATURE ON METEOROLOGY, HYDROLOGY, AND OCEANOGRAPHY FOR 1961 p 33-47 103 refs
6. IN THE MAIN ADMINISTRATION OF THE HYDRO-METEOROLOGICAL SERVICE p 48-50
7. IN THE SCIENTIFIC RESEARCH SECTIONS OF THE HYDRO-METEOROLOGICAL SERVICE p 51-53
8. NEW INSTRUCTIONS AND DIRECTIONS p 54-56

N63-10681 Joint Publications Research Service, Washington, D. C.
TRANSLATIONS FROM METEOROLOGIYA I GIDOROLOGIYA [MOSCOW] (METEOROLOGY AND HYDROLOGY), NO. 8, JULY 1962
L. T. Matveyev, A. M. Baranov, Ye. P. Novosel'tsev, G. I. Kogan-Seletskiy, and M. V. Belyakov Nov. 26, 1962 83 p 124 refs Transl. of seven articles from p 3-15, 31-32, 42-46, 54-62
(JPRS-16348) OTS: $8.10

CONTENTS:

1. ESTIMATION OF THE HEIGHT OF THE UPPER BOUNDARY AND THE VERTICAL THICKNESS OF STRATUS CLOUDS L. T. Matveyev p 1-14 3 refs
2. ON THE STRATIFICATION OF FRONTAL CLOUDS A. M. Baranov p 15-24 8 refs
3. ON THE WATER CONTENT OF CLOUDS OF THE UPPER STRATUM Ye. P. Novosel'tsev p 25-30 7 refs
4. ON A METHOD OF DETERMINING CLOUD BOUNDARIES WITH AIRCRAFT G. I. Kogan-Seletskiy p 31-43 5 refs
5. V. P. PETROV, A. A. SOCHIVKO, "ARTIFICIAL SATELLITES OF THE EARTH AND WEATHER" (GIDROMETEOIZDAT, LENINGRAD 1961), [REVIEW OF] M. V. Belyakov p 44-52
6. LITERATURE ON METEOROLOGY, HYDROLOGY AND OCEANOGRAPHY IN 1961 (CONTINUATION) p 53-70 101 refs
7. ANNIVERSARY MEETINGS p 71-80

N63-10691 National Severe Storms Project, Kansas City, Mo.
A REPORT OF THE KINEMATIC PROPERTIES OF CERTAIN SMALL-SCALE SYSTEMS
Dansy T. Williams Washington, Weather Bureau, Oct. 1962 26 p 6 refs Presented at the Conf. on Severe Storms, Norman, Okla., Feb. 13-15, 1962
(NSSP-11)

Small-scale computations of surface divergence, vorticity, deformation, and Petterssen's frontogenetical function were made with respect to a squall line, an isolated thunderstorm, and a depression wave line. The leading edge of the squall line was found to lie along an axis of maximum convergence deformation, and frontogenesis. Centers of maximum convergence, deformation, and frontogenesis were found in the vicinity of a micro-low along the leading edge of the squall line. Kinematic properties with respect to the depression wave were comparatively weak and poorly defined. They were strong and well-defined with respect to the center of the isolated thunderstorm and the pseudo cold fronts enclosing it. The kinematic properties of the systems give some indication as to the immediate short-period mechanisms responsible for the growth and decay of the systems. Author

N63-10888 Army Electronics Research and Development Activity, White Sands Missile Range, N. Mex.
METEOROLOGICAL DATA REPORT, AEROBEE AC 3.353 (AF-88A)
Len Carter Dec. 1962 40 p 2 refs
(SELWS-M-15)

Meteorological data gathered for the launching of Aerobee AC 3.353 (AF-88A) are presented, along with calculated ballistic data. Author

N63-10941 McGill U. Arctic Meteorology Research Group, Montreal (Canada)
INSOLATION AND ABSORBED SOLAR RADIATION AT THE GROUND IN THE ARCTIC Scientific Report No. 5
E. Vowinckel and Svenn Orvig Oct. 1962 63 p 19 refs
(Contract AF 19(604)-7415)
(*Its* Publ. in Meteorology 53; AFCRL-62-1068)

The calculation of insolation was based on two steps: determination of clear-sky radiation, and correction to actual conditions dependent on cloud conditions. Extraterrestrial radiation, solar height (air mass), ozone absorption, water vapor absorption, atmospheric dust absorption, and ground albedo are discussed in turn. With these basic data, the clear sky radiation of the ground was calculated. Correction to actual radiation on the ground was then performed, using previously published studies on cloud-type frequencies and depletion by different cloud types over the Arctic. Author

N63-10942 McGill U. Arctic Meteorology Research Group, Montreal (Canada)
ALBEDO OF ARCTIC SURFACES Scientific Report No. 6
P. Larsson and Svenn Orvig Oct. 1962 47 p 18 refs
(Contract AF 19(604)-7415)
(*Its* Publ. in Meteorology 54; AFCRL-62-1069)

This publication consists of tabulations of area occupied by 5% albedo classes per 5° latitude belt expressed as a percentage of the total area of each belt. These tabulations are based, in the first instance, upon monthly maps. In order to supply more detailed information for this task, the maps were reexamined. In the course of the reexamination specific albedo values, based upon data given in the literature examined, were assigned to the classes used in the maps. Transitional zones, where applicable, were inserted by assuming a gradient of albedo between classes. Albedos are tabulated for both direct and diffuse radiation conditions where they differ significantly. The direct radiation albedo information is presented graphically for each month in the form of stereograms. Tables of solar declination and duration of daylight for areas north of 60° N are given. Author

N63-10975 Joint Publications Research Service, Washington, D. C.
TRANSLATIONS FROM IZVESTIYA AKADEMII NAUK SSR, SERIYA GEOFIZICHESKAYA [MOSCOW] (NEWS OF THE ACADEMY OF SCIENCES USSR, GEOPHYSICAL SERIES), NO. 10, OCTOBER 1962
S. L. Zubkovskiy (Inst. of Atmospheric Phys., Acad. of Sci. USSR) et al Dec. 17, 1962 35 p 25 refs Transl. of p 1425-1440 and 1450-1455
(JPRS-16711) OTS: $3.60

CONTENTS:

1. FREQUENCY SPECTRA OF PULSATION OF THE HORIZONTAL COMPONENT OF WIND VELOCITY IN THE GROUND LAYER OF AIR S. L. Zubkovskiy (Inst. of Atmospheric Phys., Acad. of Sci. USSR) p 1-12 14 refs
2. THE TRANSFER COEFFICIENT DETERMINED BY COMPARING THE SIZE OF IMPRESSIONS ON TAPES COVERED WITH A LAYER OF MAGNESIUM OXIDE OR WITHOUT SPECIAL COVERING, TO THE DIAMETER OF DROPS Huang Mei-yuan p 13-22 6 refs
3. FORMATION OF RIME ON FROZEN DROPS OF WATER IN AN ELECTRICAL FIELD V. M. Muchnik and Yu. S. Rud'ko (Ukrain. Sci. Res. Hydrometeorol. Inst.) p 23-27
4. CRYSTALLIZATION OF SUPERCOOLED WATER BY SILVER IODIDE V. N. Balabanova and T. N. Zhigalovskiya p 28-32 5 refs

N63-10979 Joint Publications Research Service, Washington, D. C.
PROBLEMS OF AEROMAGNETIC AND MARINE EXPLORATION IN THE USSR
M. A. Vasil'yeva, I. I. Vlasova, and V. F. Gurevich Dec. 7, 1962 17 p Transl. of two articles from Razved. i Promysl. Geofiz. (Moscow), no. 44, 1962 p 111-116 and 123-126
(JPRS-16568) OTS: $1.60

CONTENTS:

1. SOME PROBLEMS IN COMPILING THE 1:1,000,000 COMPOSITE MAP OF MAGNETIC ANOMALIES OF THE USSR M. A. Vasil'yeva and I. I. Vlasova p 1-8
2. APPLICATION OF RADIOGEODESY IN MARINE GEOPHYSICAL EXPLORATION V. F. Gurevich p 9-14

N63-10981 Joint Publications Research Service, Washington, D.C.
ATLAS OF THE DIURNAL AMPLITUDES OF AIR TEMPERATURE IN THE USSR
D. A. Ped', Z. L. Turketti, and Kh. P. Pogosyana, ed. Dec. 13, 1962 19p Transl. of the Annotation and the Foreword from the monogram "Atlas Sutochnykh Amplitud Temperatury Vozdukht v SSSR", Leningrad, Central Inst. of Weather Forecasting, 1962 p 2-11
(JPRS-16667) OTS: $1.60

This atlas gives the distribution of the mean, highest and lowest diurnal amplitudes of the temperature of air at various overcasts of the sky over the USSR. The atlas is designed to be used by geophysicists, meteorologists, geographers, and weather forecasters who are directly associated with weather forecasting. J.R.C.

22 NAVIGATION AND GUIDANCE

Includes: autopilots; star tracking; inertial platforms; and traffic control.

For related information see: 06 Auxiliary Systems; 08 Communications; 09 Electronics; 10 Facilities; 15 Instrumentation; 20 Mathematics; and 29 Space Sciences.

N63-10632 Joint Publications Research Service, Washington, D. C.
EVALUATION OF THE PRECISION OF CALCULATION OF THE POSITION OF AIRCRAFT
T. Iwan Nov. 26, 1962 13 p Transl. from Wojskowy Przeglad Lotniczy (Warsaw), no. 7, July 1962 p 14-20 *In its* Military Information on East Europe, No. 42, p 119-127
(JPRS-16338) Distributed by OTS

The average quadratic deviation method is reviewed for determining the random errors in measurements of an aircraft's position. Examples are given for finding the accuracy of radiometric systems. R.C.M.

N63-10734 National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio
ANALYSIS OF GUIDANCE PERTURBATIONS FOR A LOW-THRUST MARS ORBITER MISSION USING SNAP-8
Alan L. Friedlander Washington, NASA, Dec. 1962 83 p 5 refs
(NASA TN-D-1433) OTS: $2.25

A typical low-thrust Mars orbiter mission using the Snap-8 power-generating system is studied from a guidance viewpoint. For each of the three characteristic mission phases, the sensitivity of the final trajectory state (velocity, position, and mass) due to errors in the initial trajectory state and to thrust-vector errors is presented. The analysis is based on linear perturbation theory; however, it is augmented to account for the effects of large thrust-vector perturbations. In general, low-thrust trajectories are found to be highly sensitive to various sources of error. Author

23 PHYSICS, GENERAL

Includes: acoustics; cryogenics; optics; and thermodynamics.

For astrophysics see: 05 Astronomy and Astrophysics.

For related information see: 12 Geophysics; 29 Space Sciences; 24 Physics, Plasma; and 24 Physics, Solid-State.

N63-10587 Oak Ridge National Lab., Tenn.
PULSE HEIGHT CALCULATIONS FOR A PARALLEL PLATE IONIZATION CHAMBER CONTAINING ELECTRON ATTACHING GASES
H. B. Eldridge Nov. 21, 1962 24 p 3 refs
(Contract W-7405-eng-26)
(ORNL-3090) OTS: $0.50

When the pulse from a parallel plate electrode ionization chamber containing an attaching gas is examined with a linear pulse amplifier having the proper integration and differentiation time constants, the pulse height will be a simple analytic function of the attachment coefficient and the electron drift velocity. The expressions for the pulse height as a function of the partial pressure of the attaching gas, electron drift velocity, attachment coefficient, chamber geometry, and amplifier time constants are evaluated. Author

N63-10636 Toronto U. Inst. of Aerophysics (Canada)
AERODYNAMIC SOUND FROM FLUID DILATATIONS. A THEORY OF THE SOUND FROM JETS AND OTHER FLOWS
H. S. Ribner July 1962 125 p 55 refs
(Supported by Defence Research Board of Canada and USAF)
(UTIA-86; supersedes UTIA-67; AFOSR-TN-3430)

An alternative to the quadrupole theory of flow noise is given in terms of simple sources. In this view, the volume of a fluid element fluctuates inversely as the local pressure: part of this dilatation generates sound and another part propagates the sound. The local pressure consists of a quasi-incompressible "pseudosound" $p^{(o)}$ plus the sound field (relatively weak in low speed flows). The effective part of the dilatations appears in a virtual acoustic source strength $\sim \partial^2 p^{(o)}/\partial t^2$. Author

N63-10641 California U., Los Angeles
STABILITY OF FILM BOILING TWO-PHASE FLOW IN CRYOGENIC SYSTEMS
T. H. K. Frederking [1962] 56 p 39 refs
(NASA Grant NsG-237-62)
OTS: $5.60 ph, $1.88 mf

The stability of film boiling two-phase flow is investigated, in particular, as applied to saturated cryogenic liquids. The theoretically predicted stabilization due to capillarity is reduced considerably in liquefied gases with low surface tension, such as hydrogen. This effect causes the transition to turbulent flow to occur at low Reynolds numbers, and increases the heat transport in the turbulent regime. A comparison with experimental data (horizontal cylinder) shows that the "critical" film Reynolds number $\bar{u}\delta/\nu$, at which instabilities become effective, is lowered from approximately 200 (O_2) to about 30 (H_2). Author

N63-10646 Columbia U., New York, N. Y.
THE EFFECT OF A MOVING LOAD ON A VISCOELASTIC HALF-SPACE Technical Report No. 12
J. W. Workman and H. H. Bleich Nov. 1962 49 p 13 refs
(Contract Nonr-266(34))
(CU-1-62-ONR-266(34)-CE)

The effect of a line load moving with constant velocity V along the surface of an elastic half-space has been studied. The present paper treats the equivalent problem for a viscoelastic (standard solid) material when the velocity V is less than the velocity c_s of shear waves of high frequencies ($\Omega \to \infty$). Previously, no solution could be obtained when the velocity V was equal to the velocity of Rayleigh waves. The present analysis yields a solution for this special velocity. It also permits an evaluation of the effects of viscosity at other values of V. In certain ranges these effects are minor, but in other ranges major differences occur due to focusing phenomena. Author

N63-10647 Columbia U., New York, N. Y.
AN APPROXIMATION IN PROBLEMS OF WAVE PROPAGATION IN COMPLEX VISCOELASTIC MEDIA Technical Report No. 13
W. R. Spillers and H. H. Bleich Oct. 1962 8 p 5 refs
(Contract Nonr-266(34))
(CU-2-62)

The approximation method of Bleich and Sackman is extended to the problem of wave propagation in viscoelastic materials which have a more complex response than the standard solid. The interpolation makes use of the known discontinuity at the wave front and the known longtime value of the response. Starting with the Laplace transform, the transform of the response is expanded in a series, the inversion of which gives a series of exponential terms which are multiplied by a power series. An example problem is given to illustrate the procedure. R.C.M.

N63-10653 Naval Ordnance Lab., White Oak, Md.
A COMPLETE E, P, V, T, S THERMODYNAMIC DESCRIPTION OF METALS BASED ON THE P, u MIRROR-IMAGE CONCEPT
Julius W. Enig Sept. 1962 29 p 12 refs
(NOLTR-62-149)

The well-known practice of using the mirror-image, in the P, u plane, of the shock Hugoniot curve about a vertical line through the shocked state P_H, u_H is shown to give a complete thermodynamic description of metals when the U(shock velocity) vs. u_H relationship and $\alpha \equiv V^{-1}(\delta V/\delta T)_{P=O}$ are known. Use of the experimental relationship $U = c_o + au_H$ (a and c_o constants) and α = constant, leads to a thermodynamic description which results in the metal appearing less compressible than if described by the Mie-Grüneisen equation of state. Furthermore, the existence of an anomalous behavior of c_p in the low-pressure neighborhood (<10 to <50 kbar depending on the metal) of the initial state rules out the simultaneous existence of a Hugoniot satisfying the linear U vs. u_H relationship, of isentropes satisfying the mirror-image assumption, and of a constant value of α in this neighborhood. Thermodynamic functions for 16 metals are calculated up to 2 megabars and compared with the results obtained from the Mie-Grüneisen equation of state. Author

N63-10658 Naval Radiological Defense Lab., San Francisco, Calif.
PRECISION MAGNETIC FIELD MEASUREMENTS USING HALL GENERATORS
T. S. Dahlstrom, H. A. Howe, W. M. Mallet, and W. E. Smith Apr. 24, 1962 42 p
(USNRDL-TR-559)

A detailed description of the temperature coefficient of the Hall potential, the internal resistance of the semiconductor, is presented along with a description of a temperature compensating network which yields a magnetic field measuring probe with a temperature coefficient of less than 0.01%/° C over a magnetic field range from 6 to 25 kgauss. The importance of thermal time constants of the semiconductor is discussed and some measurement results presented. Author

N63-10676 General Dynamics Corp. General Atomic Div., San Diego, Calif.
RESEARCH STUDIES ON ANALYSIS OF IONIZED GASES Final Report
William R. Snow July 31, 1962 20 p 7 refs
(Contract DA-49-146-XZ-049)
(GA-3358; DASA-1329)

Mass spectrometric studies have been made of afterglows in helium, nitrogen, oxygen, hydrogen, and water. The afterglow was produced by either 20 mev electrons or radio-frequency excitation. Future experiments are planned for these gases. R.C.M.

N63-10690 Carnegie Inst. of Tech., Pittsburgh, Pa.
COOLING OF AN ANTIFERROMAGNET BY ADIABATIC MAGNETIZATION Technical Report No. 14
J. H. Schelleng and S. A. Friedberg Nov. 1, 1962 11 p 17 refs
(Contract Nonr-760(05))

The heat capacity of powdered $MnBr_2 .4 H_2O$ has been measured between 1.4° and 20° K in applied magnetic fields up to 24 k oe. The shift of the Néel point to lower temperatures with increasing field has been observed. A series of adiabatic magnetization measurements from initial temperatures above and below the zero field Néel point ($T_N(O) = 2.13°$ K) have been carried out. For $T_i < T_N(O)$ the anticipated cooling effect is observed for applied fields smaller than that required to make the salt paramagnetic. Adiabatic data have been used to locate the curves of entropy vs. temperature computed from the heat capacity relative to the curve for H = O.

N63-10711 General Electric Co., Santa Barbara, Calif.
AN EVALUATION OF VARIOUS METHODS FOR PRODUCING NEGATIVE IONS
Douglas H. Archer [Oct. 1962] 47 p 53 refs
(RM-62TMP-32)

This report analyzes the various ways by which negative ions (particularly the lighter ions such as H^- and D^-) can be produced; estimates the maximum current of negative ions attainable by each

method (without regard to beam quality); and indicates the most fruitful lines of approach for generation of large currents. The general conclusion is that the largest currents of H^- (or D^-) can be produced by the charge-exchange technique. Author

N63-10740 Midwestern Universities Research Association, Madison, Wis.

TRANSVERSE SPACE CHARGE EFFECTS IN PARTICLE ACCELERATORS

Dornis C. Morin, Jr. (Ph.D. Thesis-Wisconsin U.) Aug. 10, 1962 163 p 25 refs

(Contract AT(11-1)-384)

(MURA-649) OTS: $2.75

An analysis of transverse space-charge effects in particle accelerators is made by means of the Boltzmann equation. With suitable assumptions, a closed set of moment equations is obtained which describes the behavior of the beam. It is found that the motion of the center of the beam is independent of the space-charge forces and that space-charge effects cannot put the beam onto an integral resonance. Conditions are obtained for an approximate stationary solution for which the center and width of the beam remain constant. It is shown that, in the absence of magnetic field errors, the beam width oscillates if the conditions for a stationary solution are not satisfied and that this oscillation is always stable. A linear theory for the effect of field gradient errors on the beam width for small perturbations from the stationary solution indicates that unstable resonances may exist. Some possible ways of extending the analysis are discussed. Author

N63-10761 Laboratoire d'Infra-rouge Technique et Appliqué, Gif-sur-Yvette (France)

STUDY OF THE EDGE EMISSION OF CADMIUM SULPHIDE BOMBARDED BY ELECTRONS Final Technical Report, 1 Oct. 1961-30 Sept. 1962

[1962] 17 p

(Contract N 62558-2720)

A grating spectrograph and electron gun have been developed to study the spectra of cadmium sulfide. The spectrograph was constructed by adding a driving mechanism to the grating (3.25 m focal length) of a concave grating spectrometer. The associated electron gun furnishes high energy electrons (25,000 volts) for bombarding the sample. The spectra of cadmium sulfide has been studied at 77° K and 4.2° K. In the first experiment, the electron current was between 1 and 30 μA and the anode voltage was held at 20,000 volts. Observations were made of the band 4800Å to 5050Å and of the band around 5100Å. In the second experiment, the electron current was between 0.1 and 1 μA and the anode voltage was held at 10,000 volts. The bands observed were in the vicinities of 4870Å and 4883Å. R.C.M.

N63-10767 India. Dept. of Atomic Energy. Physics Advisory Committee, Bombay

PROCEEDINGS OF THE [SIXTH ANNUAL] NUCLEAR PHYSICS SYMPOSIUM, MADRAS, FEBRUARY 28-MARCH 2, 1962

R. Ramanna May 5, 1962 447 p 278 refs

The symposium report consists of sixty-eight papers devoted principally to nuclear reactions, nuclear spectroscopy, nuclear magnetic resonance, electron paramagnetic resonance, neutron scattering and diffraction and radiation damage. P.F.E.

N63-10775 European Atomic Energy Community, Brussels (Belgium)

COURBES DE RAYONNEMENT GAMMA RELATIVES À L'ACIER, À L'ALUMINIUM ET À L'URANIUM [GAMMA RADIATION CURVES FOR STEEL, ALUMINUM AND URANIUM]

J. Frippiat and R. Nicks Joint Nuclear Research Center, Ispra Establishment (Italy), Reactor Physics Dept., Oct. 1962 18 p In French; English summary

(EUR-103.f) Available from Belgian American Bank and Trust Co., N. Y., account No. 121.86: 30 Belg. Fr.

The report specifies the gamma doses due to the thermal neutron activation of steel, aluminum, and uranium; the doses are normalized to 1-gram emitters and distances of 1 cm. Author

N63-10784 Princeton U. Plasma Physics Lab., N. J.

DETECTION AND LOCATION OF CAVITATION

C. P. Kittredge Aug. 1962 41 p 5 refs

(Contract AF(30-1)-1238)

(MATT-142)

An investigation is made of the detection of cavitation noise in a pipeline by means of an accelerometer attached to the exterior of a pipe. It was found that a very low level of noise produced by intermittent cavitation can be detected over a distance of more than 200 pipe diameters. The best results were obtained from oscilloscope traces which showed no noise preceding the noise produced by the nearly simultaneous collapse of a group of bubbles. J.R.C.

N63-10802 National Aeronautics and Space Administration, Washington D. C.

THERMODYNAMIC CALCULATIONS OF CARBON MONOXIDE—AIR DETONATION PARAMETERS FOR INITIAL PRESSURES FROM 1 TO 100 ATMOSPHERES

Loren E. Bollinger and Rudolph Edse (Ohio State U. Rocket Research Lab.), 1962 30 p

(NASA Grant NsG-44-60)

(NASA TN D-1667) OTS: $0.75

The composition, temperature, pressure and density behind a stable detonation wave and its propagation rate have been calculated for five mixtures of carbon monoxide and air at 1, 5, 25, and 100 atmospheres initial pressure, and at an initial temperature of 313.16° K. The results of these calculations show that the detonation velocities of stoichiometric carbon monoxide—air mixtures increase with increasing initial pressure whereas those of very rich and very lean mixtures are independent of the initial pressure. Author

N63-10870 California U., Berkeley. Lawrence Radiation Lab.

HIGH-ENERGY NUCLEAR REACTIONS OF NIOBIUM WITH INCIDENT PROTONS AND HELIUM IONS

Ralph Garret Korteling (Ph.D. Thesis) Sept. 10, 1962 108 p 86 refs

(Contract W-7405-eng-48) OTS: $2.25

(UCRL-10461)

High-energy nuclear reactions initiated by protons and helium ions on niobium have been investigated. Specific reaction products were selected to represent the low and high deposition-energy processes as well as the production of low-mass products. Excitation functions for these products were determined between the energies 240 to 720 mev for incident protons, and 320 to 880 mev for incident helium ions. The results from the proton bombardments were compared with values obtained from a Monte Carlo calculation of the cascade-evaporation model. The results from the proton bombardments were also compared with those from helium-ion bombardments. Experimental information for the identification and decay properties of the niobium-88 isotope is given Author

N63-10871 California U., Berkeley. Lawrence Radiation Lab.

SPONTANEOUS FISSION OF THE HEAVIEST ELEMENTS

Sven A. E. Johansson Sept. 25, 1962 25 p 19 refs

(Contract W-7405-eng-48)

(UCRL-10474) OTS: $.50

The spontaneous-fission rates of nuclei with $Z \geq 98$ have been calculated. Deviations of these fission rates from the general trend

predicted by the liquid-drop model are attributed to the fine structure of the single-particle level diagram. Calculations reproduce the experimental values reasonably well, particularly the rapid drop in half-life with increasing neutron number just above neutron number 152. Contrary to previous predictions, results show that this drop is a local effect and that the half-lives soon start to increase with increasing neutron number. Heavy, neutron-rich nuclei therefore have considerable stability against spontaneous fission. Based on the predicted half-lives, the possibilities of producing very heavy nuclei are discussed. The implications of the present results for neutron capture in supernovae explosions are discussed. Author

N63-10874 Ohio State U. Research Foundation, Columbus
MOLECULAR ORBITALS FOR H_2 BASED ON CENTRAL POTENTIALS AVERAGE HAMILTONIAN AND CORRELATION ENERGY Scientific Report No. 1
James M. Peek and Edwin N. Lassettre Sept. 1962 31 p 8 refs
(Contract AF 19(604)-4541)
(AFCRL-62-1041)

The molecular orbitals for hydrogen are studied based on central potentials, average Hamiltonian and correlation energy. The analysis shows that the molecular energy differs from the actual energy by an amount consisting of a sum of two terms, one from the potential energy and the other from kinetic energy. The potential energy term is the difference between an uncorrelated average and a term involving a correlated average. It is assumed that the two potential energy terms would cancel if a physically justified potential v_R were employed and this view was investigated by imposing a constraint which makes the potential energy terms vanish. The average of the Hamiltonian operator is given for molecular hydrogen using, as a trial function, a product of two functions which are solutions of the Schrödinger equation. J.R.C.

N63-10877 Franklin Inst. Labs., Philadelphia, Pa.
RESEARCH ON SPONTANEOUS MAGNETIZATION IN SOLID BODIES
Angus Neaves Wright-Patterson AFB, Ohio, Directorate of Materials and Processes, Apr. 1962 40 p 10 refs
(Contract AF 33(616)-7499)
(ASD-TDR-62-375)

A series of very fine particle ferrites ranging in size from 18Å to 200 Å has been subjected to magnetic resonance investigation. These particles show an increasing shift in resonance field with decreasing particle size. The behavior of this shift with decreasing temperature is more complicated. These and other results are discussed on the basis of two ferromagnetic resonance equations. The first of these equations removes the restrictions generally imposed in the derivation of the equation of ferromagnetic resonance. This equation should be useful in the description of resonance in macroscopic single crystal ferrites. The second equation takes account of the superparamagnetic nature of the particles and predicts results qualitatively in agreement with those observed. Some work on nickel oxide particles exhibiting weak ferromagnetic and superparamagnetic effects is described. Author

N63-10886 Avco-Everett Research Lab., Everett, Mass.
SHOCK TUBES FOR HIGH TEMPERATURE GAS KINETICS
Arthur Kantrowitz Oct. 1962 51 p 53 refs Presented at the Fiftieth Anniversary Solvay Conf., Brussels, Nov. 5-10, 1962
(Avco-Everett Res. Rept.-141)

Diaphragm type shock tubes are capable of heating gases to temperatures sufficient for the study of all chemical reactions and many electronic processes. Knowledge of the gas state in shock tubes has allowed the development of numerous diagnostic devices and their applications to a tremendous variety of problems in gas kinetics. The advent of electromagnetically driven shock tubes opens up the possibility of achieving similar advantages at temperatures up to millions of degrees. An assessment is made in this paper of the degree to which a HGS has been produced in this temperature range. It is concluded that in some cases evidence exists for this achievement. Author

N63-10899 Cornell Aeronautical Lab., Inc., Buffalo, N. Y.
SPECTRAL INVESTIGATIONS IN THE WAVELENGTH REGION AROUND 1 MM. VI. DESIGN OF A PULSED MASS RADIATOR AND ITS CHARACTERISTICS AS A SPECTROSCOPIC RADIATION SOURCE
Wilfried Eckhardt [1962] 26 p 16 refs Transl. by J. Lotsof from Z. Physik (Berlin), 160 (1960), 121-143
(CAL Translation)

An attempt to develop the mass radiator proposed by Glagolewa-Arkadiewa into a radiation source to record absorption spectra at the long wavelength end of the infrared region in a relatively short time is discussed. In a mass radiator a large number of small metal particles, each of which can be regarded as a Hertzian dipole, are caused by spark excitation to emit strongly damped waves. Since the individual dipoles of a mass radiator are not coupled with a secondary energy source, they can radiate only as much energy as they absorb during the spark excitation. The signal-to-noise ratio can be significantly increased by providing excitation voltage in pulses of short duration, short rise time, and of an amplitude above the static breakdown voltage. Rapid voltage collapse and prevention of the absorption of the emitted radiation are accomplished by using a pulse shaped voltage. Thermic receivers were found to be inadequate for following the rapid changes in radiation intensity, so crystal detectors were manufactured according to microwave spectroscopy designs and used with a waveguide antenna. When incorporated into a spectrometric optical system, the mass radiator was found to be a radiation source suitable for recording spectra in the range $\lambda \geq 1.5$ mm with an information content an order of magnitude greater than that attainable with the conventional Hg lamp. Below this range, the time required to prepare the mass radiator operation makes the use of the Hg lamp more profitable. M.P.G.

N63-10901 Boston U., Mass.
THEORETICAL INVESTIGATIONS ON THE CORRELATION THEORY OF ELECTROMAGNETIC FIELDS Final Report [1 Feb. 1961 to 31 Jan. 1962]
P. Roman Feb. 1962 9 p 11 refs
(Contract AF 19(604)-8022)
(AFCRL-62-92)

Theoretical investigations are made to extend the correlation theory of stationary electromagnetic fields. In the great majority of electromagnetic measurements, the field vectors vary so rapidly that no detector can record their behavior. Measurements can only be made of the time averages of certain bilinear functions of the field components. Electromagnetic correlation tensors have been introduced in connection with an attempt to formulate the theory of rapidly varying statistical fields in terms of measurable quantities. J.R.C.

N63-10909 Naval Radiological Defense Lab., San Francisco, Calif.
RADIATION EFFECTS IN THERMOELECTRICS. I. TECHNIQUES FOR DETECTION OF TRANSIENT EFFECTS AND THEIR APPLICATION TO COMMERCIAL GRADE BISMUTH TELLURIDE
J. W. Winslow and R. R. Hart Sept. 13, 1962 81 p 7 refs
(USNRDL-TR-581)

Two satisfactory laboratory methods for detecting and studying transient radiation effects on Seebeck coefficient, S, and electrical resistivity, ρ, of materials having large thermoelectric figures of merit, z, have been developed. The transient effects of intense beams of 2 Mev electrons on z in commercially available, thermoelectric grade bismuth telluride, have been deduced from separate observations of S and ρ made using these methods, together with previously

reported observations of thermal conductivity. These observations indicate that ionizing radiation has no transient effects on the point value of τ, within experimental limits of accuracy amounting to $\pm 50\%$. However, secondary effects, very probably arising from inhomogeneity of the test material, were observed. A simple model for, and some of the implications of, these observations are discussed. Author

N63-10927 Battelle Memorial Inst., Columbus, Ohio
SOME RADIATION EFFECTS IN GaAS
L. W. Aukerman and R. D. Graft *In* Soc. of Aerospace Mater. and Process Engr. Symp. on Effects of Space Environment on Materials, St. Louis, May 7, 8, and 9, 1962 25 p 33 refs (See N63-10912 02-01)
(Supported by USAF)

In this paper the known radiation effects in GaAS are summarized and, when possible, comparisons with other device materials are made Author

N63-10955 Aro, Inc., Arnold Air Force Station, Tenn.
THE RADIATIVE PROPERTIES OF CARBON DIOXIDE CRYODEPOSITS AT 77°K
Development Center, Dec. 1962 29 p 15 refs
(Contract AF 40(600)-1000)
(AEDC-TDR-62-165)

The results of an investigation to determine the effect of a carbon dioxide cryodeposit on the radiative properties of a metallic surface are presented. A calorimetric-type experiment is described. Data are presented for the total hemispherical reflectance versus the thickness of carbon dioxide frost formed on polished copper, a Parson's black surface, and on two surfaces which were partially polished copper and partially Parson's black. Of particular significance was the fact that a common reflectance value was not reached as the frost thickness increased. An explanation for this effect is given in terms of a selective absorption characteristic. Author

N63-10962 Bolt, Beranek, and Newman, Inc., Cambridge, Mass.
SOUND RADIATION FROM A BEAM ATTACHED TO A PLATE
Richard H. Lyon Repr. from J. Acoust. Soc. Am., v. 34, no. 9, pt. 1, Sept. 1962 p 1265-1268 7 refs
(NASA Contract NASr-47)

The sound power radiated by acoustically slow waves scattered by a beam is computed. An acoustic radiation resistance per unit length of beam is computed based on the radiated power and the mean-square transverse plate velocity in the absence of the beam. For a diffuse reverberant vibrational field and supported, clamped, or edge-supported lines, explicit expressions for the radiation resistance are obtained. The reduction of radiation coupling due to beam vibration is also computed. Author

N63-10989 Illinois U., Urbana
RESPONSE OF A LINEAR TWO DEGREE OF FREEDOM SYSTEM EXCITED BY TWO DISTINCT AND INDEPENDENT FREQUENCIES
John A. Kasuba and Will J. Worley Nov. 1962 34 p 11 refs
(T&AM-237)

The system consists of a machine coupled to its frame through a viscous damper and a linear spring. The frame is in turn coupled to the foundation through a viscous damper and a linear spring. The system is confined to translational motion in the vertical plane. Excitations enter the system through a rotating eccentric mass attached to the machine and through vertical sinusoidal displacement of the foundation. Response of the system to the dual excitations at distinct frequencies is presented as dimensionless absolute displacement, velocity, acceleration and force transmissibility ratios. Author

N63-10999 Linfield Research Inst., McMinnville, Ore.
RESEARCH ON SPUTTERING PHENOMENA, SURFACE STABILITY AND VOLTAGE BREAKDOWN FOR ALKALI-COATED REFRACTORY ELECTRODES Final Report, 1 May 1961 to 30 Apr. 1962
R. W. Strayer, E. C. Cooper, L. W. Swanson, and F. M. Charbonnier [1962] 48 p 17 refs
(NASA Contract NASr-19)
OTS: $4.60 ph, $1.64 mf

Cesium coated tungsten has been tested under conditions which prevail in ion propulsion systems to obtain a better knowledge of the behavior of thin layers of alkali metals on refractory metal electrodes. The tests made include surface migration, evaporation rates, and voltage breakdown. The experimental methods used were pulsed field emission projection microscopy and the voltage breakdown tube. Activation energies for surface migration have been determined as a function of crystallographic direction and degree of coverage. Photographs of field emission patterns after exposure for 60 seconds at temperatures between 77° K and 970° K show the migration and thermal desorption of cesium on tungsten. This data permits the prediction of surface migration rates over a wide range of temperatures and the ionic and atomic desorption for degrees of coverage up to one monolayer. Prebreakdown currents were measured directly for cesium coverage up to one monolayer, voltages up to 20 kv, and gross field strengths up to 5 Mv/cm. These data indicate that, at room temperature, breakdown between cesium-coated tungsten electrodes does not occur unless very high voltage gradients are applied and that the breakdown is probably initiated by field emission. R.C.M.

24 PHYSICS, PLASMA

Includes: fusion; and magnetohydrodynamics.

For related information see: 05 Astronomy and Astrophysics; 23 Physics, General; and 25 Physics, Solid-State.

N63-10618 Avco-Everett Research Lab., Everett, Mass.
DISSIPATION IN HIGH TEMPERATURE PLASMAS
H. E. Petschek Sept. 1962 8 p 2 refs Presented at the American Physical Society Plasma Physics meeting, Tarrytown, N. Y., Apr. 13-14, 1962 Prepared for journal publication
(Contract Nonr-2524(00))
(AMP-93)

An investigation is made of the dissipation in turbulent high temperature plasmas. The basic characteristics of turbulence in a plasma are that more or less random fluctuations exist and that these fluctuations have sufficiently large amplitudes so that nonlinear interactions are important. In a plasma almost any motion (except a vortex precisely aligned with the magnetic field) distorts the magnetic field and therefore has a restoring force. Since the different waves comprising the turbulence move relative to one another, the nonlinear interactions will tend to be between waves which have not previously interacted. It may, therefore, be justified to assume that the interacting waves have random phases. J.R.C.

N63-10656 Aerospace Corp. Physical Research Lab., El Segundo, Calif.
OBSERVATION OF INSTABILITIES IN A PLASMA INJECTED INTO A Bz FIELD
Alan J. Toepfer Nov. 1, 1962 17 p 5 refs
(Contract AF 04(695)-169)
(TDR-169(3210-02)TN-1; SSD-TDR-62-146)

Photographic observations were made of a plasma blob injected into a nonvarying axial magnetic field. The plasma was axially confined for periods of time up to three microseconds, after which instabilities developed. Radial accelerations of the plasma-magnetic

field boundary were estimated to be an order of magnitude less than in recent theta pinch experiments. Initial conditions at the plasma-magnetic field boundary indicate the possibility of the development of the flute, or interchange, instability. Author

N63-10682 Aerospace Corp. Physical Research Lab., El Segundo, Calif.

EXPERIMENTAL MAGNETOHYDRODYNAMIC TURBULENCE INVESTIGATIONS

E. B. Turner Aug. 16, 1962 26 p 4 refs
(Contract AF 04(695)-69)
(DCAS-TDR-62-167; TDR-69(2230-14)TR-1)

Previous investigations of MHD turbulence are reviewed briefly, and a short description of the apparatus, a stabilized linear pinch device, is presented. Improvements in the frequency response of the magnetic probes and RC integrators and modifications to the design of the high-pass filters are discussed. Experimental results obtained are presented. Author

N63-10689 Southwest Center for Advanced Studies, Dallas, Tex.

HYDROMAGNETIC REFLECTION AND REFRACTION AT A FLUID VELOCITY-DISCONTINUITY

J. A Fejer Oct. 23, 1962 21 p 16 refs Prepared for journal publication
(NASA Grant NsG-269-62)
OTS: $2.60 ph, $0.83 mf

The problem of hydromagnetic reflection and refraction at a fluid velocity-discontinuity is solved. Expressions for the propagation vector of the refracted wave and for the reflection coefficient are derived. It is found that the reflected and refracted waves are pure characteristic waves if the incident wave is a pure characteristic wave. Author

N63-10697 Brown Engineering Co., Inc., Huntsville, Ala.

PARAMETERS INFLUENCING RADAR RETURNS FROM RE-ENTRY VEHICLE WAKES

Harry C. Crews, Jr. May 31, 1962 42 p 18 refs
(Contract DA-01-009-ORD-1019)
(Tech. Note R-1)

Using Maxwell's equations, the equations which describe electromagnetic wave propagation in a weakly ionized plasma are derived considering collisions. These equations are expressed in both electrical (permittivity and conductivity) and optical (index of refraction) terms. The dependence of plasma propagation properties on the flow chemistry and aerodynamics is described, and a method of relating flow properties to propagation properties is outlined. Author

N63-10706 Aerospace Corp. Physical Research Lab., El Segundo, Calif.

THE MAGNETOHYDRODYNAMIC FLOW PAST A NONCONDUCTING FLAT PLATE IN THE PRESENCE OF A TRANSVERSE MAGNETIC FIELD

D. M. Dix Apr. 25, 1962 64 p 11 refs
(Contract AF 04(647)-930)
(TDR-930(2230-03)TR-2; DCAS-TDR-62-88)

The general character of the magnetohydrodynamic flow past a nonconducting flat plate in the presence of transverse magnetic fields is analyzed in some detail. The appropriate extension of the Rayleigh problem to the magnetohydrodynamic case is shown to yield solutions which correctly predict some features of the steady flow past a semi-infinite flat plate; in addition, it is shown that the knowledge of these significant features permits an easy evaluation of their magnitudes in other extensions of the Rayleigh problem. The results obtained show that the disturbance produced by the plate is no longer confined to a thin viscous layer if the ratio of viscous to magnetic diffusivity is greather than 10^{-2}, but that an appreciable Alfvén type disturbance is excited. Author

N63-10724 Armed Services Technical Information Agency, Arlington, Va.

PLASMA PHYSICS AND MAGNETOHYDRODYNAMICS. AN ASTIA REPORT BIBLIOGRAPHY

Merrill F. Aukland, comp. Mar. 5, 1962 273 p 1350 refs
(AD-271-170) OTS: $2.75

This bibliography contains abstracts covering the following: electron-ion collisions, electromagnetic waves, gas ionization, magnetic pinch effects, microwaves, plasma jets, plasma sheaths, propellants and propulsion, oscillations, nuclear applications, reentry aerodynamics, shock waves and shock tubes, and solar and extra-terrestrial effects. R.C.M.

N63-10727 Brown Engineering Co., Inc., Huntsville, Ala.

A MODEL FOR PREDICTION OF THE ELECTROMAGNETIC INTERACTION WITH THE WAKE OF RE-ENTRY BODIES

J. E. White, Jr. May 15, 1962 27 p 7 refs
(Contract DA-01-009-ORD-1019)
(Tech. Note R-25)

The laminar wake of a reentry vehicle is simulated by a system of cylindrical plasma shells. The radar cross section per unit length is found, taking into account the energy losses due to collisions. Author

N63-10732 General Applied Science Labs., Inc., Westbury, N. Y.

EFFECT OF COLLISION FREQUENCY UPON SCATTERING CROSS SECTIONS OF CYLINDRICAL PLASMA CONFIGURATIONS WITH RADIALLY VARYING ELECTRON DENSITY

Sulmo Mariano and Frank Lane Dec. 5, 1962 41 p
(Contract NOrd-18053)
(Tech. Rept. 324)

This report describes a computation and numerical results obtained for the determination of the effects of collisions upon scattering cross sections for an electromagnetic plane wave incident normally upon an idealized model of a wake of a missile or other hypersonic flying objects. Of particular interest are the effects of collision between electrons and neutral particles. Author

N63-10760 Polytechnic Inst. of Brooklyn, N. Y.

RADIATION BY A UNIFORMLY ROTATING POINT CHARGE

Manlio Abele June 1962 34 p 6 refs
(Grant AF-AFOSR-1-63)
(PIBAL-753)

The spectral distribution of the radiation emitted by a uniformly rotating point charge in a dielectric medium is evaluated and compared to the Cerenkov radiation of a uniformly moving charge. Two particular cases of dispersive medium are analyzed. First, the orbit of the charge is assumed to be enclosed in a perfectly conducting cylinder which acts as a mirror for the radiation; in the second case, the charge rotates around a dielectric rod, and an analysis is conducted of the excitation of waves which propagate along the rod. Author

N63-10764 General Mills Electronics Group, Minneapolis, Minn.

ANNUAL REPORT ON SPUTTERING YIELDS, COVERING PERIOD OF 1 NOVEMBER 1961 TO 31 OCTOBER 1962

G. K. Wehner, R. V. Stuart, and D. Rosenberg Nov. 15, 1962 74 p 50 refs
(Contract Nonr-1589(15))
(Rept. 2356)

Sputtering-yield measurements for various metals under noble gas ion bombardment in the energy range 50 to 600 ev have been essentially completed. Results for metals, including some rare earths, under He^+-, Ne^+-, Ar^+-, Kr^+-, Xe^+-, and Hg^+-ion bombardment are presented in over 200 yield curves. The spectroscopic technique for measuring sputtering threshold energies is described. Velocity

distributions of atoms sputtered from polycrystalline and single crystal Cu targets are presented. Average velocities are found to be in the range 3 to 10 ev, in good agreement with previous measurements and much higher than those of thermally evaporated atoms. Author

25 PHYSICS, SOLID-STATE

Includes: semiconductor theory; and masers.

For related information see: 09 Electronics; 23 Physics, General; and 24 Physics, Plasma.

N63-10752 Ames Lab., Iowa State U. of Science and Tech.
POSITRON ANNIHILATION IN SOLIDS
A. R. Mackintosh Oct. 1962 34 p 20 refs
(Contract W-7405-eng-82)
(IS-299) OTS: $0.75

The experimental study of the angular correlation of the photons from the annihilation of positrons with electrons in solids is discussed, with particular reference to the information about the electronic structure which can be derived from the results. Approximate calculations are made of the angular distribution of coincidences for an interacting electron gas, a superconductor, a collective-electron ferromagnet and a liquid metal, and the results are compared with experiment. A number of experiments designed to explore the electronic structure of solids are suggested, and possible improvements in experimental technique are proposed. Author

N63-10759 Tufts Coll., Bedford, Mass.
SPECTROSCOPIC INVESTIGATIONS OF SOLID STATE SURFACES CONTAINING ADSORBED MOLECULES Final Report
M. Kent Wilson Bedford, Mass., Air Force Cambridge Research Labs., Electronics Research Directorate, May 31, 1962 69 p 61 refs
(Contract AF 19(604)-4063)
(AFCRL-62-585)

Several cells suitable for observing the infrared spectra of molecules adsorbed on solid surfaces are described. Preliminary experiments with a GeO_2 gel gave promise of producing a very useful substrate for future spectroscopic work. Some understanding of the effect of surroundings on the vibrational frequencies of groups involving germanium and silicon has been achieved. Author

26 PROPELLANTS AND COMBUSTION

Includes: fuels; igniters; and oxidizers.

For related information see: 07 Chemistry; and 27 Propulsion.

N63-10600 Purdue U., Lafayette, Ind.
RESEARCH IN NITROMONOMERS AND THEIR APPLICATION TO SOLID SMOKELESS PROPELLANTS Annual Progress Report No. 24, Sept. 15, 1961 - Oct. 14, 1962
Henry Feuer Nov. 30, 1962 92 p 55 refs
(Contract Nonr-1100(31))

Polynitro compounds have been produced by addition reactions with nitro olefins produced *in situ* from nitroalkyl acetates. These reactions have been studied for the possible production of solid smokeless propellants. A convenient method is included for determining molecular weights of the salts of mononitro compounds. R.C.M.

N63-10627 National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio
EFFECT OF COMPOSITION ON COMBUSTION OF SOLID PROPELLANTS DURING A RAPID PRESSURE DECREASE
Carl C. Ciepluch Washington, NASA, Dec. 1962 14 p 8 refs
(NASA TN D-1559) OTS: $0.50

The response of solid-propellant combustion to a pressure transient was studied in an apparatus that could be vented at a variable rate. The principal measurement was the time required for the pressure to decrease to one-half its initial value. The data are presented and discussed in terms of τ, the maximum value of the time required to extinguish combustion. The results indicate that the ease with which solid-propellant combustion may be extinguished is strongly dependent on physical factors such as the average size and the thermal conductivity of solid particles contained in the propellant. Analysis of the results suggested that hot-particle retention at the surface of the propellant was a major cause of the continuance of combustion in a rapidly decreasing pressure field. An examination of the data also indicated no correlation between τ and the propellant-strand burning rate. Author

N63-10701 Aerojet-General Corp., Sacramento, Calif.
STUDY OF MECHANICAL PROPERTIES OF SOLID ROCKET PROPELLANTS Period Covered: 30 Jan. 1961 through 30 Jan. 1962
James H. Wiegand et al Mar. 1962 398 p 102 refs Appendices A through G of this report previously processed as separate document; for abstract see N62-14298 12-22
(Contract AF 33(600)-40314, S/A. No. 1)
(Report 0411-10F)

Research was performed on improved methods of measuring the mechanical properties of composite solid propellant, analyzing the response behavior for values essential to stress analysis, performing theoretical and experimental stress analysis on simple tubular grains, establishing failure criteria for such grains, and developing a method of integrating such experimental and theoretical processes with the grain design and propellant development functions to give an optimum method of grain design for reliable solid propellant motors. Author

N63-10702 California U., Berkeley. Space Sciences Lab.
POSSIBLE ELEMENTAL ABUNDANCES OF THE LUNAR CRUST
Ann Palm and Robert G. Strom Repr. from Publ. Astron. Soc. Pacific, v. 74, no. 439, Aug. 1962 p 316-322 10 refs
(NASA Grant NsG-145-61)

Possible rock types consonant with some of the recent hypotheses concerned with the origin of the moon's surface structures have been derived. These materials were compared with common terrestrial rocks, meteorites, and tektites of known chemical compositions, and a most probable set of elemental abundances of the lunar crust was deduced for each hypothesis. Oxygen, Si, Al, Fe, Mg, Ca, Na, K, and Ni are the principal elements that distinguish the rock types. Therefore, the abundance ratios of these elements constitute one of the important criteria for deciding whether volcanic or impact mechanisms predominated in the shaping of the surface features. J.R.C.

N63-10730 John Hopkins U., Baltimore, Md.
MICROSTRUCTURE OF A HYDROGEN-BROMINE FLAME
J. Francis Wehner and George C. Frazier, Jr. Sept. 1962 74 p 49 refs
(NSF Grant G-15433)

A novel experimental apparatus and analytical system have been developed and successfully used in a quantitative study of the

microstructure of a laminar hydrogen-bromine flame. The results indicate that the reactions which dominate the H_2-Br_2 system at low temperature are the only important ones at flame temperatures, to a first approximation. However, the steady-state approximation with respect to Br atoms appears invalid in the flame. Estimates of the thermal diffusion effect indicate that this factor may contribute as much as one-third to the total hydrogen diffusive flux in this flame. Author

N63-10766 Tokyo U. Aeronautical Research Inst. (Japan)
SOME STUDIES ON SOLID PROPELLANTS. PART II. BURNING RATE OF THE PERCHLORATE-POLYESTER (CASTABLE) PROPELLANTS
Kenji Kuratani Sept. 1962 15 p 4 refs
(*Its* Rept. 373 (Vol. 28, No. 5))

To find out the correlation between the burning rate of propellant and the thermal decomposition rate of ammonium perchlorate, the burning rates of propellants composed of ammonium perchlorate (AP) and polyester are measured at one atmosphere. The experimental procedures are defined precisely to obtain the reproducible result. Between the effects of various catalysts on the burning rate of propellant and on the pyrolysis rate of AP, there is no appreciable correlation. Moreover, the poor correlation between the burning rate and combustion temperature of propellant is also found. The burning rate up to the higher pressure region is also measured by Crawford method. Author

N63-10880 Thiokol Chemical Corp., Elkton, Md.
DEVELOPMENT OF SOLID ROCKET PROPELLANT SYSTEM CAPABLE OF WITHSTANDING EXTENDED STORAGE IN SPACE ENVIRONMENT Quarterly Progress Report No. 2 [Aug. 18-Nov. 19, 1962]
H. G. Jones, Robert M. Brownell, J. C. Merges, R. A. Biddle, and K. Haley Dec. 12, 1962 59 p 1 ref
(Contract AF 04(611)-8188)
(E194-62)

A study is made of solid propellant systems capable of withstanding extended storage in a space environment. Tentative results of the data analyzed indicate that the polyurethane-based propellant, TP-G-3129, appears to offer the best space-storage performance. From the standpoints of weight loss and physical property change (hardening) under vacuum exposure, this propellant exhibits the most desirable qualities, followed by the Minuteman and Dyna Soar propellants TP-H-1011 and TP-H-1050. These formulations also show an ability to withstand aging as shown by sol-gel ratio analysis and modulus values. J.R.C.

N63-10956 Armour Research Foundation, Chicago, Ill.
FUNDAMENTALS OF LIQUID PROPELLANT SENSITIVITY Final Report, June 13, 1961 through Sept. 12, 1962
T. A. Erikson and E. L. Grove Nov. 26, 1962 68 p 6 refs
(Contract NOw 61-0603-c)
(ARF-3197-15)

The purpose of the investigation is to identify and characterize the parameters affecting the explosive sensitivity of liquid propellants. With nitroglycerine as a representative propellant, background and experimental techniques were established for shock-tube and flash-irradiation tests. Results of the two tests were evaluated in terms of a time delay, measured from the reception of an initiating stimulus to a detonation identified by a characteristic reverberation signal. For both tests, vaporization is concluded to be the rate-controlling step, followed by a fast reaction in the gas phase. At constant temperature, vaporization rates are influenced profoundly by local pressure increases. An external pressure of about 50,000 psia will increase the vaporization rate of nitroglycerine sufficiently to support a detonation in the gas phase. Therefore, a cascading pressure effect, similar to the Arrhenius temperature runaway, is proposed as complementary step in the mechanism which controls the initiation and propagation of a detonation in a liquid propellant system. Author

N63-10993 Monsanto Research Corp. Boston Labs., Everett, Mass.
RESEARCH ON SYNTHESIS OF NEW OXIDIZERS FOR SOLID PROPELLANTS Quarterly Technical Summary Report No. 1, July 1, 1962—Sept. 30, 1962
James W. Dale, Henry P. Beltramini, Carl A. Olson, Stephen P. Terpko, and George A. Tsigdinos Dec. 10, 1962 11 p 6 refs
(Contract AF 04(611)-8520; ARPA Order 352-62)
(MRB2022Q1)

The objectives of this research are (a) the study, by conductimetric means, of metathetic reactions of compounds involving the ions ClF_2^+ and ClF_4^- in various inert solvents such as ClF_3, HF, OF_2, etc.; and (b) the study of various energetic oxidizing compounds such as NF_3, $ClNO_3$, $FClO_3$, etc., with liquid OF_2 and further examination of the behavior of selected combinations of these agents in liquid OF_2 as a solvent, where feasible. Author

27 PROPULSION

Includes: airbreathing, electric, liquid, nuclear, and solid propulsion.

For related information see: 04 Aircraft; 06 Auxiliary Systems; 26 Propellants and Combustion; and 30 Space Vehicles.

N63-10650 National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
NOISE MEASUREMENTS DURING CAPTIVE AND LAUNCH FIRINGS OF A LARGE ROCKET-POWERED VEHICLE
William H. Mayes and Philip M. Edge, Jr. Washington, NASA Nov. 1962 34 p 9 refs
(NASA TN D-1502) OTS: $1.00

Near- and far-field data were obtained while the exhuast was deflected 90° by a water-cooled turning bucket as well as when the exhaust was free of the bucket deflector. In addition, some measurements were made along and around the surface of the vehicle during captive firing. The data include overall sound pressure levels, spectra, time durations above a certain level, instantaneous pressures for transient and steady operating conditions, and pressure amplitude distributions. Author

N63-10652 Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena
ANALYSIS OF THE THERMAL DESIGN LIMITATIONS OF SOLID-CORE REACTORS FOR NUCLEAR PROPULSION
D. R. Bartz Nov. 15, 1962 45 p 16 refs
(NASA Contract NAS7-100)
(JPL-TR-32-217) OTS: $4.60 ph $1.55 mf

An analysis of the thermal design limitations of gas-cooled solid-core nuclear reactors for rocket propulsion is presented. Closed-form integrated gas-dynamics equations coupled with variable-property heat-transfer equations are utilized to show qualitative relationships between important parameters. Numerical results from the equations are presented for designs in which hydrogen is used as the working fluid, for parallel-plate and parallel-hole core configurations. Of the two principal thermal design limitations—pressure drop and thermal stress—the latter appears to be more important for conditions of practical interest. Author

N63-10735 National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio
SPACE-CHARGE-FLOW THEORY AND ELECTRODE DESIGN FOR ELECTROSTATIC ROCKET ENGINES

David L. Lockwood and Vladimir Hamza Washington, NASA, Dec. 1962 100 p 24 refs
(NASA TN D-1461) OTS: $2.25

The basic theory of space-charge flow is described, and three general methods of solution are discussed. Specific space-charge-flow geometries are described in detail. Included are the following: flow between coaxial cylinders, concentric spheres, coaxial cones, hyperbolic flow, flow between inclined planes, and circular flow. Since all the solutions discussed are for space-charge-limited flow, a discussion of partial space-charge flow is presented. The Pierce method of electrode design is described, and some practical limitations of this method are discussed. Electrode shapes for various space-charge flows are shown. Author

N63-10881 National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio
AN ELECTRON-BOMBARDMENT ION ROCKET OPERATED WITH ALTERNATING-CURRENT SUPPLIES
Paul D. Reader and Robert C. Finke Washington, NASA, Dec. 1962 34 p 3 refs
(NASA TN D-1457) OTS: $1.00

Power-supply weight savings and increases in reliability may result from the operation of an electron-bombardment ion rocket on alternating-current supplies instead of on the normal direct current. This approach was investigated with the alternating-current effects determined for 60-cycle sinusoidal wave forms. Results indicate that a compromise system, with three of the five necessary supplies operated with alternating current, was competitive with total direct-current operation. Author

N63-10883 Naval Radiological Defense Lab., San Francisco, Calif.
A SCINTILLATION DETECTION SYSTEM FOR THE INSPECTION OF LARGE SOLID PROPELLANT ROCKET MOTORS
K. F. Sinclair and H. A. Zagorites May 31, 1962 20 p 4 refs
(USNRDL-TR-589)

A simple continuous-scan scintillation-type flaw-detection system was designed, fabricated, and tested. This equipment, when used with a suitable radiation source and automated test specimen, produces signals on a strip-chart recorder proportional in amplitude to the volume of small defects in the test specimen located on the radiation source-detector axis. Observed performance has been adequate for many test applications, and the measured sensitivity compares well with theoretically predicted performance levels. Author

N63-10971 National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio
NASA RESEARCH ON RESISTANCE HEATED HYDROGEN JETS
John R. Jack Oct. 1962 19 p 5 refs Prepared for the 3rd AFOSR Symp. on Advanced Propulsion Concepts, Cincinnati, Oct. 2-4, 1962
(Paper E-1895) OTS: $1.60 ph, $0.80 mf

An electrical propulsion scheme using resistance heated hydrogen jets was studied because of the potential advantages of such an engine in efficiency, reliability, simplicity, variable thrust and long life. Basically, hydrogen is heated by passing it over or through a refractory metal heat exchanger prior to expansion in a nozzle. Heat exchanger temperatures and operating pressure levels were investigated, and an experimental engine was designed. Experimental program results were obtained for input powers ranging from 0 to 38 kilowatts, heat exchanger temperatures as high as 4900° R and propellant flow rates of 5×10^{-4}, 7.5×10^{-4} and 1×10^{-3} pounds per second. The thrust was found to increase from a cold flow value of 0.25 pounds to a value of 0.73 pounds at an input power of 38 kilowatts, which corresponds to a specific impulse increase from 250 seconds to 730 seconds. The amount of thrust expected in a vacuum space environment at highest operating power is 0.9 pounds with a corresponding vacuum specific impulse of 1000 seconds. The experimental performance data agree closely with a one-dimensional flow calculation. Comparisons of the data obtained at the different propellant flow rates demonstrated a further advantage of this propulsion system by showing that engine thrust can be varied considerably without affecting the specific impulse. M.P.G.

N63-10972 National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio
THE ELECTRON-BOMBARDMENT ION ROCKET
Harold R. Kaufman Oct. 1962 22 p 14 refs Prepared for the 3rd AFOSR Symp. on Advanced Propulsion Concepts, Cincinnati, Oct. 2-4, 1962
(Paper E-1862) OTS: $2.60 ph, $0.86 mf

Research on the electron-bombardment ion rocket has progressed far enough to permit the research problems on this engine to be evaluated. The two major obstacles to efficient long-life operation have been the accelerators and the cathode. The nature of the accelerator erosion problem is understood and the research in this area is nearly completed. Although the cathode area has not progressed as far, two very efficient designs are being studied. Firm estimates of expected performance show power requirements as low as 100 kilowatts per pound of thrust. Author

N63-10996 Republic Aviation Corp. Plasma Propulsion Lab., Farmingdale, N. Y.
TERRESTRIAL HYPERSONIC FLIGHT PROPULSION. PHASE I: [DETONATIVE PROCESSES.] PHASE II: [APPLICATIONS]
Kenneth M. Foreman Sept. 1, 1962 50 p 7 refs
(Contract AF 49(638)-552)
(RAC-964; PPL-TR-62-2)

A preliminary feasibility study is made of two detonative processes for sustained hypersonic propulsion using the terrestrial atmosphere. The processes are evaluated in the light of their energy production and flight energy requirements. Several proposed hypersonic airbreathing propulsion system applications, including electrical augmentation, are evaluated. The required features of an airborne electrical power supply are specified. Within the limits of an analytical approach, an electromagnetic fuel injection afterburner combined with a standing wave detonation device appears the most promising. Author

28 SPACE RADIATION

Includes: cosmic radiation; solar flares; solar radiation; and Van Allen radiation belts.

For related information see: 05 Astronomy and Astrophysics; 16 Life Sciences; and 29 Space Sciences.

N63-10668 General Dynamics/Astronautics. Space Science Labs., San Diego, Calif.
BLACKBODY RADIATION TABLES
Carmine C. Ferriso Sept. 1962 673 p
(Contract AF 19(628)-422; ARPA Order 30-61)
(AE62-0862)

The hemispherical spectral radiant intensity of a blackbody radiator has been evaluated between 100,000 cm^{-1} and 5 cm^{-1} over the temperature range 5° K to 10⁸ °K. Author

N63-10679 Atomic Energy Commission. Div. of Technical Information, Washington, D. C.
YIELD OF THE RADIOLUMINESCENCE OF ORGANIC MATERIALS

Z. A. Chizhikova Nov. 1962 75 p 85 refs Transl. by JPRS of "Vykhod Radiolyuminestsentsii Organicheskikh Veshchestv" from Tr. Fiz. Inst., Akad. Nauk SSSR (Moscow), 15, 1961 p 178-229 (AEC-TR-5377) OTS: $1.75

The radiation spectra of organic materials excited by gamma rays and alpha particles have been investigated to determine the portion of the energy of the particle which is transformed into luminescence. The compounds studied include the following: crystals of tolane, stilbene, naphthalene, terphenyl, and dibenzyl; sodium salicylate in water; quinine sulfate in water; 3-aminophthalimide in ethyl alcohol; and anthracene in acetone. The efficiency of the luminescence was found to average 3.9% for the solutions and 4.1% for the crystals. The agreement of these values indicates that the extinction of luminescence is not due to molecular interaction. R.C.M.

N63-10873 Rochester U., N. Y.

ON THE ENERGY DEPENDENCE OF FRAGMENTATION OF COSMIC RAY NUCLEI IN INTERSTELLAR SPACE

H. H. Aly and M. V. K. Appa Rao Nov. 2, 1962 20 p 19 refs Submitted for publication

(Contract AT(30-1)-875)

(NYO-10249)

The energy dependence of fragmentation probabilities for cosmic-ray nuclei in interstellar hydrogen is investigated, using the data that exists from experiments in which protons of various energy bombard different nuclei. The probability of a medium nucleus (C,N.O.F) going into a light nucleus (Li,Be,B) in an interaction of a medium nucleus in hydrogen (P_{ML}) seems to be energy independent up to energies of the order of 6 Bev per nucleon, whereas the probability of a heavy nucleus ($Z > 10$) going into a light nucleaus (P_{HL}) seems to be strongly energy dependent. The above results imply that the interstellar matter traversed by cosmic-ray nuclei, as deduced from the abundance of light nuclei, is dependent on the energies under consideration. Author

N63-10903 Iowa State U., Iowa City

REPLY TO THE DISCUSSION BY W. N. HESS

Guido Pizzella, C[arl] E. McIlwain, and J[ames] A. Van Allen Repr. from J. Geophys. Research, v. 67, no. 12, Nov. 1962 p 4888-4889

(NASA Grant NsG-233-62)

The increase in the intensity of the inner Van Allen belt is shown to be independent of changes in the primary galactic cosmic-ray intensity and of changes in the atmospheric density during the observational period. R.C.M.

N63-10905 Iowa State U., Iowa City

ELECTRONS IN THE EARTH'S OUTER RADIATION ZONE

W. G. V. Rosser, B. J. O'Brien, J. A. Van Allen, L. A. Frank, and C. D. Laughlin Repr. from J. Geophys. Research, v. 67, no. 12, Nov. 1962 p 4533-4542 11 refs

(NASA Grant NsG-233-62)

Preliminary results from Explorer 12 during August and September 1961 show that near the geomagnetic equatorial plane the omnidirectional intensity of 40- to 55-kev electrons is usually constant to a factor of 2 or 3 between radial distances of 25,000 and about 55,000 km; then it diminishes rapidly near the termination of the earth's magnetic field, which is generally at about 65,000 km. Typical midzone values for electrons between 40 and 55 kev are 10^6 to 10^7 electrons $(cm^2\ sec)^{-1}$. The intensity of 80- to 100-kev electrons shows a similar radial dependence and a similar absolute value, but diminishes toward zero at a lesser radial distance. Hence the outer fringe of the outer zone at about 10 earth radii has a much steeper electron spectrum than the inner portion. The general structure of the outer zone as measured with a 302 Geiger tube during the past four years is confirmed but is now shown to correspond to electrons of energy greater than 1.6 Mev in intensities of 10^3 to 10^5 $(cm^2\ sec)^{-1}$ in the heart of the zone. Important spectral changes accompany geomagnetic storms. Author

29 SPACE SCIENCES

Includes: space chemistry; cosmology; lunar and planetary exploration; and theoretical analysis of orbits and trajectories.

For space biology see: 16 Life Sciences.

For related information see: 05 Astronomy and Astrophysics; 12 Geophysics; and 22 Navigation and Guidance.

N63-10640 Joint Publications Research Service, Washington, D.C.

MICROBES AND THE COSMOS

N. I. Rybakov Nov. 28, 1962 28 p 11 refs Transl. of the book "Mikroby i Kosmos" Moscow, 1962 32 p

(JPRS-16402) OTS: $2.60

The role of microbiology in the space sciences is discussed to point out the areas were microorganisms can be used to study the space environment. These studies include the preparation for manned space flight, interplanetary contamination, and the search for extraterrestrial life. R.C.M.

N63-10771 Victoria U., Wellington (N. Zealand)

THE DISTRIBUTION OF LIFE IN THE SOLAR SYSTEM: AN EVALUATION OF THE PRESENT EVIDENCE

Michael H. Briggs Sept. 1962 25 p 156 refs Preprint

This paper assesses current information concerning the present distribution of life in the solar system before transfer of terrestrial forms has occurred. The paper covers the possibility of life on meteorites, on the inner planets, on the outer planets, and on extrasolar planets. J.R.C.

N63-10803 Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena

A NUCLEAR ELECTRIC SPACE-BUS FOR PLANETARY LANDING MISSIONS

Robert J. Beale and Evelyn W. Speiser N. Y., Am. Rocket Society [1962] 8 p 4 refs Presented at ARS Electric Propulsion Conf., Berkeley, Calif., Mar. 14-16, 1962 For abstract see N62-12748 08-26

(NASA Contract NAS 7-100)

(ARS Paper 2390-62) ARS: $0.50 members, $1.00 nonmembers

Studies have shown that a nominal 300-kwe nuclear-electric-powered spacebus having a gross weight of 16,000 pounds can perform significant planetary landing missions to the inner planets. This paper discusses the capabilities of such a spacecraft and examines a typical design approach to utilize these capabilities. The spacecraft considered employs a nuclear turboelectric power system which supplies power to the primary propulsion device, an ion motor. Author

N63-10868 National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

DIFFERENTIAL CORRECTION FOR VINTI'S ACCURATE INTERMEDIARY ORBIT

N[ino] L. Bonavito Washington, NASA, Dec. 1962 18 p 3 refs

(NASA TN D-1445) OTS: $0.50

This report presents an orbit-improvement method in which mean values of certain parameters characteristic of Vinti's kinetic equations are obtained for a series of observations in a predetermined time interval and are used to determine the corresponding set of Izsak elements which exactly factor Vinti's two quartic polynomials. As a consequence, predicted positions and velocities for an earth satellite

at any time can be obtained. This report also includes a section on the partial derivatives resulting from the first order Taylor expansion of the conditional equations. Author

N63-10875 Aerospace Medical Div. School of Aerospace Medicine, Brooks AFB, Texas

STUDIES WITH A SIMULATED MARTIAN ENVIRONMENT: BACTERIAL SURVIVAL AND SOIL MOISTURE CONTENT

Thomas L. Roberts and E. Staten Wynne Nov. 1962 7 p 9 refs (SAM-TDR-62-121)

In a simulated Martian environment based on the latest available data, colony counts of a sporeforming bacterium increased. There were no changes in soil moisture. Multiple entry into Mars jars did not affect counts or soil moisture. Author

N63-10910 National Aeronautics and Space Administration, Washington, D.C.

STATEMENT BY ROBERT C. SEAMANS, JR., ASSOCIATE ADMINISTRATOR, NATIONAL AERONAUTICS AND SPACE ADMINISTRATION, BEFORE THE COMMITTEE ON SCIENCE AND ASTRONAUTICS, UNITED STATES HOUSE OF REPRESENTATIVES, FEBRUARY 27, 1962

Robert C. Seamans, Jr. 1962 63 p

OTS: $6.60 ph, $2.09 mf

The NASA programs are summarized along with the related manpower and budget requirements. The following areas are covered: Space Sciences; Applications; Manned Space Flight; Advanced Research and Technology; and Tracking and Data Acquisition. R.C.M.

N63-10948 California U., Los Angeles. Inst. of Geophysics and Planetary Physics

ON THE INTERNAL CONSTITUTION OF THE INNER PLANETS

Gordon J. F. MacDonald Repr. from J. Geophys. Research, v. 67, no. 7, July 1962 p 2945-2974 80 refs

(NASA Grant NsG-216-62)

The internal structures of the Moon, Mars, Venus, and Mercury are examined in the light of what is known about the constitution of the Earth. The gravitational figure of the Earth, as obtained from satellite orbits, is used to estimate the possible deviations from hydrostatic equilibrium on other planets. The astronomical data on the mean density and gravitational figure of Mars receive critical examination. It is concluded that the radioactive composition of Mars differs from that of chondrites. The internal structures of Mercury and Venus are examined briefly in terms of their inferred rotational history. In conclusion, the inner planets differ both in the abundances of the heavy elements and in the abundances of potassium, uranium, and thorium. Author

N63-10978 Joint Publications Research Service, Washington, D. C.

A POSSIBLE MECHANISM OF PARTICLE EJECTION FROM THE SUN

V. S. Komel'kov Dec. 10, 1962 13 p 12 refs Transl. from Doklady Akad. Nauk SSSR (Moscow), v. 146, no. 1, 1962 p 58-61 (JPRS-16590) OTS: $1.60

Magnetohydrodynamic eddies (MHE) and their plasma jets are studied as possible accelerators for solar particles. The plasma of the current flux, compressed between the crossed $H\phi$ and H_z fields was stable for 5×10^{-6} to 2×10^{-4} sec. The v_z fluctuated between 4×10^5 and 1.5×10^7 cm/sec depending on the gas pressure and discharge currents. Fountainlike jets with 3 to 10 Kamps. current penetrate a longitudinal field to 50 Koersted. Rates of ejections from these jets ranged from 10^5 to 5×10^7 cm/sec and are similar to those observed from the sun. These studies of the MHE mechanisms indicate the possibility of generating relativistic particles in this type of accelerator. R.C.M.

30 SPACE VEHICLES

Includes: launch vehicle—spacecraft combinations; operating problems; and stability and control.

For manned space capsules, satellites, and space probes see: **32 Space Vehicles (Spacecraft).**

For boosters and rockets see: **31 Space Vehicles (Launch Vehicles).**

For related information see: **04 Aircraft; 08 Communication; and 22 Navigation and Guidance.**

N63-10736 National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

USE OF AN INERTIA SPHERE TO DAMP THE ANGULAR MOTIONS OF SPINNING SPACE VEHICLES

Jerrold H. Suddath Washington, NASA, 1962 14 p 6 refs (NASA TR R-137) GPO: $0.30

The general moment equations for a spin-stabilized vehicle with an inertia-reaction angular rate damper were considered, and it was noted that simplification would result if the damper had a spherical inertia distribution. A control system incorporating such a damper was postulated. The resulting equations were linearized, and conditions for stability were obtained from an analysis of the cubic characteristic equation. Two numerical examples were included. Author

N63-10746 Avco Corp. Research and Advanced Development Div., Wilmington, Mass.

ENTRY OF SPACE VEHICLES INTO PLANETARY ATMOSPHERES. PART I. BALLISTIC ENTRY Technical Memorandum

Philip Levine Apr. 30, 1962 44 p 25 refs (RAD-TM-62-20, Pt. I)

A literature review on planetary atmospheres is presented. The ranges of atmospheric scale heights for Mars and Venus are noted, and their subsequent effects and uncertainties in heating and loads discussed. Simplified relationships are developed for laminar and turbulent heat transfer and loads that are adequate for preliminary investigations of ballistic vehicle entries into the atmospheres of Venus and Mars. Comparison of the heat-transfer predictions with a limited amount of experimental data is included. Author

N63-10795 National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

AN ANALYSIS OF THE CONING MOTIONS OF THE FINAL STAGES OF THREE NASA SCOUT DEVELOPMENT VEHICLES

George R. Young and James J. Buglia Washington, NASA, Dec. 1962 30 p 8 refs (NASA-TN-D-1396) OTS: $0.75

A simplified analysis has been used to study the coning motions produced by separation disturbances of the final stages of three NASA Scout development vehicles. Normal, longitudinal, and transverse accelerometers, magnetometers, and antenna patterns, along with radar data, were utilized in the study. The results are given in terms of the calculated initial disturbing impulses required to give the stage a resultant flight-path deviation. The results indicated that Scout ST-2 received no discernible tipoff of the fourth stage, but Scouts ST-4 and ST-6 received initial disturbing impulses of at least 6.3 pound-seconds and 7.5 pound-seconds, respectively. Author

N63-10797 National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

LANDING CHARACTERISTICS OF A WINGED REENTRY VEHICLE WITH ALL-SKID LANDING GEAR HAVING YIELDING-METAL SHOCK ABSORBERS

Ulysse J. Blanchard Washington, NASA, Dec. 1962 45 p 5 refs
(NASA TN D-1496) OTS: $1.25

Landing-impact and slideout tests were made with a 1/10-scale dynamic model of a winged reentry vehicle landing on a hard-surface runway. An all-skid tricycle landing gear having yielding-metal energy straps was investigated. Results showed good landing characteristics over a wide range of landing conditions. Author

N63-10890 Congress. House. Committee on Science and Astronautics
METEOROLOGICAL SATELLITES Hearings before the Subcommittee on Applications and Tracking and Data Acquisition of the Committee on Science and Astronautics, U. S. House of Representatives, Aug. 28-30, Sept. 4, 11, 13, and 21, 1962
Leslie W. Cowan et al Washington, GPO, 1962 419 p
(87th Cong. 2nd Sess. Committee Print [No. 15])

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1. PROJECT DEVELOPMENT PLAN—NIMBUS Harry Press (NASA. Goddard Space Flight Center) p 1-236
2. FIRST REPORT ON THE ADVANCEMENT OF ATMOSPHERIC SCIENCES AND THEIR APPLICATION IN THE LIGHT OF DEVELOPMENTS IN OUTER SPACE World Meteorological Organization p 323-373

N63-10914 Directorate of Materials and Processes, Aeronautical Systems Div., Wright-Patterson AFB, Ohio
THE METEOROID HAZARD AND ITS SIMULATION
Alan K. Hopkins *In* Soc. of Aerospace Mater. and Process Engr. National Symp. on Effects of Space Environment on Materials, St. Louis, May 7, 8, and 9, 1962 7 p 6 refs (See N63-10912 02-01)

The nature of the problem is presented, as well as methods so far developed and proposed for accelerating particles to the supervelocities desirable for experimentation. The most significant breakthrough in accelerating macroparticles to above twenty kilometers per second is discussed. The observations and analyses of particle impact effects are covered including energy partition, penetration and spallation. Author

31 SPACE VEHICLES (LAUNCH VEHICLES)

Includes: boosters; clustered rockets; and multistage rockets.

For propulsion engines see: 27 Propulsion.

For launch vehicle - spacecraft combinations see: 30 Space Vehicles.

For related information see: 04 Aircraft; 08 Communications; and 22 Navigation and Guidance.

N63-10712 National Aeronautics and Space Administration, Washington, D. C.
LAUNCH VEHICLES OF THE NATIONAL LAUNCH VEHICLE PROGRAM
James E. Webb Nov. 1962 34 p
(NASA SP-10) Available from NASA. Office of Scientific and Technical Information, Washington, D. C.

The launch vehicles of the National Launch Vehicle Program are described. The information given for each vehicle includes: number of stages, propellants, thrust, maximum diameter, height, payload weight, first launch date, and vehicle use. The vehicles covered are: the Scout, Delta, Thor-Agena B, Atlas D, Atlas-Agena B, Titan II, Titan III, Centaur, Saturn, Advanced Saturn, and Nova. R.C.M.

N63-10968 National Aeronautics and Space Administration, Langley Research Center, Langley Station, Va.
OVERALL MISSILE DYNAMICS
Harry L. Runyon Washington, Oct. 30, 1962 58 p 21 refs
Lecture Notes of a Course Sponsored by the George Washington University in Cooperation with the Institute of Environmental Sciences and the Center for Prevention of Deterioration
OTS: $5.60 ph, $1.94 mf

An overall study of booster dynamics is presented using the launch system approach in which the effect of the control system on the loads is considered along with the effect of the structural system on the control system and the lateral bending modes. The launch vehicle system dynamics are represented mathematically and applied to the response of the vehicle to sinusoidal gusts, to the effect of varying the control system on the loads due to a wind shear input, and to the effect of flexibility on the stability of the system. The factors which must be included in an accurate representation of the system are discussed; these include vibration mode determination, atmospheric winds, fuel slosh, and spin. The longitudinal forces associated with launch acceleration and reentry deceleration must be considered the critical load sources in establishing design criteria for all components. A final loading source that is often ignored is the load associated with transportation of the vehicle from the manufacturing plant to the launch site by air, rail, truck, and ship transportation. These loads are examined and found to be significant in failure and fatigue life estimates. M.P.G.

32 SPACE VEHICLES (SPACECRAFT)

Includes: manned space capsules; satellites; and space probes.

For boosters and rockets see: 31 Space Vehicles (Launch Vehicles).

For Launch vehicle—spacecraft combinations see: 30 Space Vehicles.

For related information see: 04 Aircraft; 08 Communications; and 22 Navigation and Guidance.

N63-10895 National Physical Lab. Aerodynamics Div., Teddington (Gt. Brit.)
SOME EXPERIMENTAL OBSERVATIONS UPON THE FLOW AROUND CIRCULAR CYLINDERS FITTED WITH HELICAL STRAKES
P. G. Pugh and L. Woodgate Oct. 1962 27 p 14 refs
(NPL-AERO-1040)

This report describes a series of tests conducted with the object of elucidating the mechanism whereby the aeolian vibrations of circular cylinders may be greatly reduced by the addition of helical strakes to the cylinder surface. Most of these tests were conducted in air at a Reynolds number of 2.24×10^5, but some visual observations were made in a water tunnel at a Reynolds number of 7.61×10^4. The water-tunnel tests confirmed the conclusion drawn from the more extensive wind-tunnel tests, namely, that the predominant feature of the flow is an edge vortex which forms in the leeward side of each strake. This vortex suppresses separation of the boundary layer and causes the narrowed wake to become three dimensional in character. Author

N63-10904 National Aeronautics and Space Administration, Langley Research Center, Langley Station, Va.
A STUDY OF ABORT FROM A MANNED LUNAR LANDING AND RETURN TO RENDEZVOUS IN A 50-MILE ORBIT
Jack A. White Washington, NASA, Dec. 1962 14 p 2 refs
(NASA TN D-1514) OTS: $0.50

Analytical and simulation studies were made of some of the problems associated with abort from landing and return to an orbiting vehicle in a 50-mile lunar orbit. The present study was concentrated on abort from a hovering condition at the lunar surface, and the results are also applicable to lunar takeoff trajectories. Author

N63-10960 International Business Machines Corp. Federal Systems Div., Rockville, Md.

NASA PROJECT MERCURY: POSTFLIGHT REPORTER PROGRAM

NASA. Goddard Space Flight Center, Greenbelt, Md., May 1, 1962 (Rev.) 157 p

(NASA Contract NAS5-1376)

(MC-110) OTS: $11.50 ph, $4.91 mf

This volume discusses the broad logic used in the Postflight Reporter Program, and describes the flow of information and techniques of the subprograms as follows: monitor program, initialization programs, tape processor programs, phase processor programs, utility programs, and operating procedures. R.C.M.

33 STRESSES AND LOADS

Includes: fatigue; vibration; flutter; and structural tests.

For related information see: 02 Aerodynamics of Bodies, Combinations, and Internal Flow; 03 Aerodynamics of Wings and Control Surfaces; and 34 Structural Design.

N63-10599 General Electric Co. Valley Forge Space Technology Center, King of Prussia, Pa.

CONSTITUTIVE RELATIONS FOR HYPERVELOCITY IMPACT Quarterly Progress Report No. 6, May-Aug., 1962

T. D. Riney Eglin AFB, Fla., Air Proving Ground Center, Nov. 1962 24 p 19 refs

(Contract AF 08(635)-1713)

(APGC-TDR-62-59)

Tentative relations are presented for the equation of state, the thermodynamic and strain rate dependent flow-resistance coefficient, and the fracture criteria for a dynamic triaxial stress condition. These constitutive relations are required for the theoretical calculations being made for the axisymmetric hypervelocity impact problem. Improved hypotheses are expected to evolve as more experimental data become available and as computational experiments are performed. To facilitate the evaluation and comparison of various hypothesis, the relations are written into the computer program as subroutines. Author

N63-10635 Toronto U. Inst. of Aerophysics (Canada)

REVIEW OF FATIGUE RESEARCH AT INSTITUTE OF AEROPHYSICS (MARCH 1959-MARCH 1962) [Final Report]

E. D. Poppleton Aug. 1962 16 p 6 refs

(Contract AF 49(638)-548, SA/1(61-392))

(UTIA-21)

A brief description is given of an investigation of the fatigue of aluminum alloy specimens under random axial loading. Author

N63-10663 Boeing Co. Transport Div., Renton, Wash.

RESEARCH ON TECHNIQUES OF ESTABLISHING RANDOM TYPE FATIGUE CURVES FOR BROAD BAND SONIC LOADING [Final Report, Apr. 1961-May 1962]

J. R. Fuller Wright-Patterson AFB, Ohio, Flight Dynamics Lab., Oct. 1962 130 p 32 refs

(Contract AF 33(616)-8087)

(ASD-TDR-62-501)

Methods for establishing fatigue curves for broadband random loading were investigated. The approach was to absorb the trends indicated by the results of the experimental program, together with the results of other investigations, into an expression involving the constant cycle S-N relationship, the root-mean-square stress, and other simple parameters which could be derived from the random load-stress power spectrum and from the appropriate stress-frequency distribution. Author

N63-10700 Pennsylvania State U. Ordnance Research Lab., University Park

GENERAL INSTABILITY OF CIRCUMFERENTIALLY STIFFENED SANDWICH SHELLS SUBJECTED TO UNIFORM EXTERNAL PRESSURE

J. D. Stachiw Dec. 10, 1962 50 p 12 refs

(Contract NOrd-16597)

(Serial NOrd-16597-91)

The Bresse equation for the buckling of rings under radial pressure is modified to predict the general-instability collapse pressure of cellular sandwich shells under hydrostatic pressure. The validity of the equation is demonstrated by implosion experiments with carefully designed cellular sandwich shells, the general-instability collapse pressures of which are compared with the results obtained by the modified Bresse equation. The results indicate that the modified equation predicts the general-instability collapse pressure of cellular sandwich shells within 5 percent. This equation is recommended for use only when the ratio of shell ring depth to shell mean diameter is less than 0.1. Author

N63-10717 Illinois U., Urbana

CREEP TORSION OF SAE 1020 STEEL BARS AT ELEVATED TEMPERATURES

M. R. Shammamy and O. M. Sidebottom Jan. 1962 47 p 17 refs

(T&AM-208)

In two previous investigations, theories were presented for predicting the creep deformations of circular and noncircular cross sections. In these investigations, excellent agreement was found between theory and experiment for torsion members made of homogeneous plastics. The present investigation was undertaken to compare theories with data obtained from torsion members having circular, hollow circular, square, and rectangular cross sections, made of SAE 1020 steel and tested at 975° F. In general, the theories were found to be conservative in predicting the deformation. The discrepancy between theory and experiment was not considered excessive, since an increase in the torque by less than 10 percent would have produced deformations greater, in most cases, than that predicted by theory. Author

N63-10718 Illinois U., Urbana

A THEORETICAL AND EXPERIMENTAL ANALYSIS OF THE CREEP OF CURVED BEAMS LOADED IN PURE BENDING

R. R. Hagglund and O. M. Sidebottom Jan. 1962 81 p 39 refs

(T&AM-209)

This investigation presents a theoretical and an experimental analysis of the creep of rectangular- and T- cross section curved beams in pure bending. Two theories are developed in order to include and exclude radial stress effects. Experimental data were obtained for high-density polyethylene rectangular curved beams having R_c/c ratios of 1.53, 2.45, 3.22 and 4.43. The T-sections had R_c/c ratios of 2.34 and 2.47. A load history was applied. The theories and experiments were in agreement within ± 10 percent. Author

N63-10720 Illinois U., Urbana

AN APPLICATION OF LINEAR HARDENING PLASTICITY THEORY TO CYCLE AND PATH DEPENDENT STRAIN ACCUMULATION

P. D. Schwiebert and G. J. Moyar Jan. 1962 32 p 24 refs
(Contract AF 33(616)-8177)
(T&AM-212)

This paper is a combination of four distinct but closely related topics: the first is a documentation of the existence of cycle and path dependent plastic deformation; the second is a résumé of existing plasticity theories to determine if any existing theory in the realm of mechanics of solids can include the observed phenomenon; the third, and essentially original section, involves the specialization of an existing theory of inelastic deformation; and the fourth is a discussion of present experimental results in the light of theoretical applicability and suggested modifications to include a greater range of material behavior. Author

N63-10721 Illinois U., Urbana

ANALYTICAL ASPECTS OF CRACK STRESS FIELD PROBLEMS

George R. Irwin Mar. 1962 35 p 6 refs
(T&AM-213)

The crack-extension force concept is established in terms of two-dimensional considerations. Study of the flat elliptical crack problem reveals the two-dimensional crack-extension force concept remains applicable because, for linear elasticity, the crack border stresses and displacements correspond to plane strain. Numerical results for a normal crack at the free boundary of a semi-infinite solid can be obtained from integral equations established directly from physical aspects of the problem. The method illustrated by this example can be employed to solve other more complex problems. Author

N63-10723 Bureau of Mines. Explosives Research Lab., Pittsburgh, Pa.

HYPERVELOCITY IMPACT PHENOMENA Quarterly Report, June 1-Aug. 31, 1962

Karl R. Becker, Richard W. Watson, and Frank C. Gibson Nov. 9, 1962 22 p 1 ref

A study is made of the behind-target effects of spall fragments resulting from the impact on thin targets by high-velocity projectiles. Within the limits of scale sizes tested, the qualitative features of the population distribution of spall mass are not altered when the projectile is scaled. The percentage of the total number or total mass of spall particles found in a given element of space behind the target is independent of the projectile scale size. In a given spall system, the spall particles having higher penetration capabilities do not appear to be distributed differently than the aggregate group. Scaling of the projectile appears to affect the spall systems from scaled targets in the following manner: the number of target spall particles is proportional to the square of the projectile scale size, the number of projectile particles is proportional to the cube of the scale size, and the mass of both the target spall and projectile particles is proportional to the cube of the projectile scale size. J.R.C.

N63-10728 Brown Engineering Co., Inc., Huntsville, Ala.

CONTACT DISCONTINUITIES BETWEEN BARS AND ELASTIC FOUNDATION

Raymond C. Watson, Jr. Jan. 1962 20 p 3 refs
(Tech. Note R-22)

Consideration is given to the effects on the classic equations for bars on elastic foundation when the foundation is incapable of exhibiting tensile properties and thus produces a contact discontinuity when the deflection becomes upward. Applicable equations are presented and graphs are given for making modifications in the equations for several loading conditions. Author

N63-10742 Case Inst. of Tech., Cleveland, Ohio

INTERSTITIAL INDUCED DELAYED FAILURE OF STEEL [Technical Documentary Report, July 1962]

T. E. Scott and A. R. Troiano Wright-Patterson AFB, Ohio, Aeronautical Research Labs., Sept. 1962 48 p 35 refs
(Contract AF 33(616)-6419)
(ARL-62-425)

Similarities in the delayed failure characteristics of hydrogenated high-strength steel and nonhydrogenated high-temperature die steel tested at elevated temperatures were evaluated and compared. The almost perfect correspondence of the behavior of the two systems led to the conclusion that the same mechanism was operative in both cases. This mechanism is based on the idea of a local lowering of the cohesive strength of the lattice due to an accumulation of interstitial solute atoms to regions of high elastic strain. Author

N63-10799 National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

VARIABLE-AMPLITUDE FATIGUE TESTS WITH PARTICULAR ATTENTION TO THE EFFECTS OF HIGH AND LOW LOADS

Eugene C. Naumann Washington, NASA, Dec. 1962 25 p 12 refs
(NASA TN D-1522) OTS: $0.75

Load schedules were designed to approximate gust load statistics for tests on 2024-T3 and 7075-T6 aluminum-alloy sheet specimens and maneuver load statistics for tests on 7075-T6 specimens. The test data were analyzed by assuming linear cumulative damage, and a limited statistical analysis was used to strengthen conclusions. The value of the summation of cycle ratios was found to vary with changes in frequency of application of the highest load level for eight-step tests and with the omission of the lowest load level for four-step tests. The variation in the summation of cycle ratios was not significant when the lowest load level for eight-step tests was omitted. Author

N63-10801 National Aeronautics and Space Administration, Washington, D. C.

A GENERAL DIGITAL COMPUTER ANALYSIS OF STATICALLY INDETERMINATE STRUCTURES

Paul H. Denke (Douglas Aircraft Co.) Dec. 1962 72 p 14 refs Presented at a meeting of the Structures and Materials Panel of AGARD, Aachen, Germany, Sept. 17, 1959
(NASA TN D-1666; previously published as Douglas Aircraft Co. Engineering Paper 834) OTS: $1.75

A procedure for structural analysis, comprising a matrix formulation of the equilibrium and Maxwell-Mohr continuity equations, and an associated digital computer program, has been developed. This procedure is applicable, in its basic form, to any linear discrete structure. The method has been fully verified by comparison with test results, both in the laboratory and in proof test, and it has been shown to be a practical analysis tool in numerous applications. Author

N63-10814 Boeing Co. Transport Div., Renton, Wash.

DESIGN AND TEST EXPERIENCES WITH INSTABILITY OF MAJOR AIRFRAME COMPONENTS

Walter E. Binz, Jr. *In* NASA. Langley Research Center, Langley Station, Va. Collected Papers on Instability of Shell Structures — 1962 Dec. 1962 p 95-104 1 ref (See N63-10804 02-34)

Two test incidents involving instability of large-scale commercially built structures are described. Two classes of structure are discussed: the first, a fuselage with skin designed to buckle at low stress; and the second, a wing whose surface remains unbuckled to failure. The structure in the region of failure is defined and the failures described and illustrated. Insofar as possible, the stresses in the critical area at the time of failure are reported and compared to strength determined by analysis. Both fuselage and wing surfaces were observed to fail in the mode of a medium-range column when adequate support was provided by ribs and frames. Initial failure in the wing example was premature due to a design deficiency in rib strength. A clear illustration is given of the effect of rib stiffness on wing-surface stability. Adding stiffness to wing ribs increases the limit of surface stability to the theoretical flat-panel value. Author

N63-10815 Washington U., Seattle

ON THE BUCKLING OF THIN ELASTIC SHELLS

Ellis Harold Dill *In* NASA. Langley Research Center, Langley Station, Va. Collected Papers on Instability of Shell Structures—1962 Dec. 1962 p 105-113 12 refs (See N63-10804 02-34)

The differential equations which must be solved to predict the buckling load are reviewed. The different possible physical interpretations of these equations are discussed. Author

N63-10816 Illinois U., Urbana

BUCKLING AND POST-BUCKLING OF ELASTIC SHELLS

H. Langhaar and A. Boresi *In* NASA. Langley Research Center, Langley Station, Va. Collected Papers on Instability of Shell Structures—1962 Dec. 1962 p 115-133 16 refs (See N63-10804 02-34)

Some theoretical investigations of buckling of elastic shells are surveyed in this report. Only geometrically perfect shells are considered; initial dents and out-of-roundness are not taken into account. Several questions raised by the studies are: (a) Under what conditions is the infinitesimal theory of buckling of shells adequate? (b) How does the energy theory of buckling of shells correlate with the method based on equilibrium equations for bending moments, tensions, and shears in a buckled configuration? (c) How important are nonlinear terms in the tangential displacements u, v in the strain-displacement relations for buckling and postbuckling studies? (d) How important are the boundary conditions for u, v in affecting stability? (e) If a condition of snap-through is approached, how much external work is required to push the shell "over the hump" into the buckled configuration? (f) How reliable are mathematical approximations used previously in the infinitesimal theory of buckling of shells? Tentative and incomplete answers to some of these questions are suggested. Author

N63-10817 California Inst. of Tech., Pasadena

THE EFFECT OF INITIAL IMPERFECTIONS ON THE BUCKLING STRESS OF CYLINDRICAL SHELLS

C. D. Babcock and E. E. Sechler *In* NASA. Langley Research Center, Langley Station, Va. Collected Papers on Instability of Shell Structures—1962 Dec. 1962 p 135-142 3 refs (See N63-10804 02-34)

Techniques have been developed for making essentially "perfect" thin cylindrical shells and for making shells with definite types of initial deformations. The "perfect" shells give buckling stresses much higher than have previously been obtained. Initial deformations of the form $\Delta R = a_o \sin \frac{\pi x}{L}$ have been tested and ranges of positive a_o were found in which there was no lowering of the buckling stress. Negative values of a_o caused a decrease in the failure load. A theoretical solution, which indicated the same trends as were found experimentally, has been carried out. Author

N63-10818 Notre Dame U., Ind.

EFFECTS OF MODES OF INITIAL IMPERFECTIONS ON THE STABILITY OF CYLINDRICAL SHELLS UNDER AXIAL COMPRESSION

L. H. N. Lee *In* NASA. Langley Research Center, Langley Station, Va. Collected Papers on Instability of Shell Structures—1962 Dec. 1962 p 143-161 12 refs (See N63-10804 02-34)

The effects of definite and "indefinite" initial imperfections on the buckling and postbuckling behavior of an axially compressed cylindrical shell are analyzed by a nonlinear theory. The definite initial imperfections considered do not contribute to the reduction of the peak buckling load; while the "indefinite" imperfections, expressed in terms of a single factor introduced by Donnell, cause a reduction in the buckling strength. The physical meaning of the imperfection factor, however, needs further clarification. Two theoretical buckling processes are found to be possible. In the early stage of buckling, the cylinder may deform with a comparatively large number of waves of small amplitudes or the cylinder may deform with a comparatively small number of waves of large amplitudes. Further theoretical and experimental studies of the effects of initial imperfections and the process of buckling are suggested. Author

N63-10819 Instituto Technologico de Aeronautica, Sao Paulo (Brazil)

A REPORT ON THREE SERIES OF EXPERIMENTS AND THE DESCRIPTION OF A SIMPLIFIED MODEL OF THE THIN WALL CYLINDER AND CONE BUCKLING MECHANISM

Octavio G. S. Ricardo *In* NASA. Langley Research Center, Langley Station, Va. Collected Papers on Instability of Shell Structures—1962 Dec. 1962 p 163-172 2 refs (See N63-10804 02-34)

Three series of experiments were performed to investigate the nature of the buckling phenomenon. They were: (a) influence of an increasing dimple on the buckling load of a cylinder; (b) investigation of the strain distribution on one cylinder, after one or more waves were imposed on it; (c) measurements of lateral deflections at buckling. The results of such experiments give some support to the idea of a buckling model, which can be of eventual interest to the thin-wall cylinder and cone buckling problem, where a nonlinear system (the buckled band) is considered in series with a linear system (the unbuckled portion of the cylinder, plus the testing machine). Author

N63-10820 Polytechnic Inst. of Brooklyn, N. Y.

SOME RESULTS ON BUCKLING AND POSTBUCKLING OF CYLINDRICAL SHELLS

Joseph Kempner *In* NASA. Langley Research Center, Langley Station, Va. Collected Papers on Instability of Shell Structures—1962 Dec. 1962 p 173-186 6 refs (See N63-10804 02-34)

In this summary paper, the effects of initial deformations on the buckling and postbuckling characteristics of circular cylindrical shells under hydrostatic pressure are determined in an approximate manner. The influence of initial axisymmetric deformations is stressed. Also, the classical buckling of an axially compressed, noncircular (oval) cylindrical shell is studied. The results show that the major-minor axis ratio of the cross section has a marked effect on the critical load, and that use of the maximum radius of curvature in the formula for the classical buckling stress of a circular cylindrical shell leads to good results for moderate eccentricities. Author

N63-10821 Florida U., Gainesville

BUCKLING OF INITIALLY IMPERFECT AXIALLY COMPRESSED CYLINDRICAL SHELLS

S. Y. Lu and William A. Nash *In* NASA. Langley Research Center, Langley Station, Va. Collected Papers on Instability of Shell Structures—1962 Dec. 1962 p 187-202 8 refs (See N63-10804 02-34)

The effects of imperfections on the buckling strength of pressurized cylinders under axial compression are studied. The imperfection factor is considered in the finite-deflection compatibility equation as well as in the equilibrium equation. A new relation to express the imperfection as an explicit exponential function of pressure and radius-thickness ratio is proposed. A method for finding the exponential function is described, and the solution for the critical stress is found in a fairly simple form. The relation of decrease of stability with respect to magnitude of imperfections is found. Author

N63-10822 Deutsche Forschungsanstalt für Luft- und Raumfahrt, Brunswick, (W. Germany)

ON THE POSTBUCKLING BEHAVIOR OF THIN CYLINDRICAL SHELLS

W. F. Thielemann *In* NASA. Langley Research Center, Langley Station, Va. Collected Papers on Instability of Shell Structures—1962 Dec. 1962 p 203-216 8 refs (See N63-10804 02-34)

Results of tests on postbuckling equilibrium positions of isotropic thin-walled circular cylindrical shells under axial compression, external pressure, and combined loading are reported and compared with available theoretical results. Author

N63-10823 National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

THE EFFECT ON THE BUCKLING OF PERFECT CYLINDERS OF PREBUCKLING DEFORMATIONS AND STRESSES INDUCED BY EDGE SUPPORT

Manuel Stein *In its* Collected Papers on Instability of Shell Structures—1962 Dec. 1962 p 217-227 10 refs (See N63-10804 02-34)

Large deflection theory is used to compute buckling loads of simply supported, initially perfect cylinders under axial compression, external hydrostatic pressure, and combinations of axial compression and internal or external pressure. Important results are obtained by taking into account prebuckling deformations and stresses induced by edge support. For example, the presence of these deformations and stresses can decrease the axial-compression buckling load of an unpressurized perfect cylinder by 50 percent or more. Author

N63-10824 National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

THE MEMBRANE APPROACH TO BENDING INSTABILITY OF PRESSURIZED CYLINDRICAL SHELLS

Harvey G. McComb, Jr., George W. Zender, and Martin M. Mikulas, Jr. *In its* Collected Papers on Instability of Shell Structures—1962 Dec. 1962 p 229-237 7 refs (See N63-10804 02-34)

Recent theoretical and experimental research is briefly described to trace the development of deformation and the occurrence of collapse in pressurized circular cylindrical membranes under applied moment loading. The collapse of pure membrane cylinders is then compared with instability of pressurized cylindrical shells. This approach leads to a better understanding of the behavior of pressurized cylinders under bending loads. The results suggest possibilities for further research utilizing the membrane approach. Author

N63-10825 Northwestern U., Evanston, Ill.

INSTABILITY ANALYSIS OF CYLINDRICAL SHELLS UNDER HYDROSTATIC PRESSURE

George Herrmann *In* NASA. Langley Research Center, Langley Station, Va. Collected Papers on Instability of Shell Structures—1962 Dec. 1962 p 239-244 10 refs (See N63-10804 02-34)

This work consisted primarily in employing a general bending theory of circular cylindrical shells under the influence of initial stress, developed earlier by the same authors, to reexamine the problem, and compare the results with those of previous investigations. The outcome was the establishment of a simple, but accurate, expression for the buckling pressure applicable to a wide range of shell dimensions. Author

N63-10826 Southwest Research Inst., San Antonio, Tex.

INVESTIGATION OF YIELD COLLAPSE OF STIFFENED CIRCULAR CYLINDRICAL SHELLS WITH A GIVEN OUT-OF-ROUNDNESS

Robert C. De Hart and Nicholas L. Basdekas *In* NASA. Langley Research Center, Langley Station, Va. Collected Papers on Instability of Shell Structures—1962 Dec. 1962 p 245-253 7 refs (See N63-10804 02-34)

The effect of out-of-roundness on the yield collapse strength of ring-stiffened circular cylindrical shells under hydrostatic pressure has been determined experimentally. On the basis of the experimental data and theoretical stress distributions, empirical relations have been developed which, in conjunction with the theoretically predictable yield collapse strength of round ring-stiffened circular cylindrical shells, permit the prediction of the yield collapse strength of shells with out-of-roundness. Author

N63-10827 National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

THERMAL BUCKLING OF CYLINDERS

Melvin S. Anderson *In its* Collected Papers on Instability of Shell Structures—1962 Dec. 1962 p 255-265 11 refs (See N63-10804 02-34)

Several theoretical and experimental investigations on the buckling of cylinders due to both axial and circumferential thermal stresses are reviewed. Differences that exist among the various results are discussed and areas of future work are indicated. Author

N63-10828 College of Aeronautics, Cranfield, (Gt. Brit.)

LOCAL CIRCUMFERENTIAL BUCKLING OF THIN CIRCULAR CYLINDRICAL SHELLS

David J. Johns *In* NASA. Langley Research Center, Langley Station, Va. Collected Papers on Instability of Shell Structures—1962 Dec. 1962 p 267-276 9 refs (See N63-10804 02-34)

The problem of circumferential buckling of a thin, circular cylindrical shell due to compressive hoop stresses which vary in the axial direction is examined. For extremely localized compressive hoop stress distributions resulting from thermal discontinuity effects, or from a uniform, radial line loading, the buckle pattern should also be localized. Simplified analyses into these two types of problems are considered which show that only a limited number of buckle deflection modes need to be assumed. Author

N63-10829 Allied Research Associates, Inc., Boston, Mass.

ELASTIC AND PLASTIC STABILITY OF ORTHOTROPIC CYLINDERS

George Gerard *In* NASA. Langley Research Center, Langley Station, Va. Collected Papers on Instability of Shell Structures—1962 Dec. 1962 p 277-295 9 refs (See N63-10804 02-34)

By utilizing linear stability theory, solutions for elastic buckling of short and moderate length orthotropic cylinders under axial compression are presented and correlated with experimental results on circumferentially stiffened cylinders. The plastic buckling of short and moderate length isotropic and orthotropic cylinders is also investigated and the theoretical results correlated with available experimental data. A discussion of the effects of finite deflections and initial imperfections is presented in order to explain the correlation obtained between the theory and the experimental data. Author

N63-10830 National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

ON THE INSTABILITY OF ORTHOTROPIC CYLINDERS

Michael F. Card and James P. Peterson *In its* Collected Papers on Instability of Shell Structures—1962 Dec. 1962 p 297-308 9 refs (See N63-10804 02-34)

Preliminary results from experimental investigations on the buckling strength of ring-and-stringer stiffened aluminum cylinders and filament-wound glass-epoxy cylinders are compared with instability calculations based on small-deflection orthotropic cylinder theory. Correlation between experiment and calculation was reasonably good for the glass-epoxy cylinders; however, correlation for the ring-and-stringer stiffened cylinders can be achieved only when some of the basic wall stiffnesses for stiffened cylinders with buckled skin can be better defined. In particular, the wall shear stiffness and the wall bending stiffness in the circumferential direction need better definition. Author

N63-10831 Technological U., Delft (Netherlands)
GENERAL INSTABILITY OF ORTHOGONALLY STIFFENED CYLINDRICAL SHELLS
Arie van der Neut *In* NASA. Langley Research Center, Langley Station, Va. Collected Papers on Instability of Shell Structures—1962 Dec. 1962 p 309-321 5 refs (See N63-10804 02-34)

Earlier research at the National Aeronautics Research Institute (N.L.R.), Amsterdam, which forms the basis of recent work is reviewed. This early work refers to 2 schemes: the orthotropic shell and, in view of buckling modes where the half-wave length is of the order of the ring distance, the shell with continuously distributed stringers and discrete rings. Linear theory is considered to be adequate for these structures, where the imperfections are small in comparison to the height of the ring sections. Recent developments account for pressure difference in addition to axial compression, for the correct stiffness matrix of skin panels in the postbuckling stage and for stringer bending due to hoop stresses in the skin, which are of importance as has been shown by the investigation of the postbuckling behavior. Numerical data for the stiffness matrix of skin panels have been established. Author

N63-10832 Forest Products Lab., Madison, Wis.
BUCKLING OF LAYERED ORTHOTROPIC AND SANDWICH CYLINDRICAL SHELLS IN AXIAL COMPRESSION
Edward W. Kuenzi *In* NASA. Langley Research Center, Langley Station, Va. Collected Papers on Instability of Shell Structures—1962 Dec. 1962 p 323-330 8 refs
(See N63-10804 02-34)

Results of modifications of large-deflection theory for isotropic materials to shells constructed of orthotropic layers and sandwich are presented. Experimental evaluation of the buckling of a rather extensive series of plywood cylinders and of a few curved panels of sandwich construction shows reasonably good agreement with buckling predicted by theory. Author

N63-10833 North American Aviation, Inc. Space and Information Systems Div., Downey, Calif.
ELASTIC STABILITY OF SIMPLY SUPPORTED CORRUGATED CORE SANDWICH CYLINDERS
Leonard A. Harris and Edward H. Baker *In* NASA. Langley Research Center, Langley Station, Va. Collected Papers on Instability of Shell Structures—1962 Dec. 1962 p 331-340 8 refs (See N63-10804 02-34)

Theoretical buckling coefficients are obtained for the general instability of simply supported, corrugated-core sandwich circular cylinders under combined loads with the core oriented parallel to the longitudinal axis of the cylinder. Buckling curves are presented for axial compression, external lateral pressure, torsion, and some typical interactions. The differential equations of equilibrium used to obtain the buckling equations were derived from the small deflection equations of Stein and Mayer and include the effect of deformation due to transverse shear. These equations are solved by Galerkin's equation. Remarks are made concerning the probable validity of the results of the small deflection theory for sandwich shells. Author

N63-10834 Douglas Aircraft Co., Inc. Missile and Space Systems Div., Santa Monica, Calif.
DESIGN AND TESTING OF HONEYCOMB SANDWICH CYLINDERS UNDER AXIAL COMPRESSION
John H. Cunningham and Marcus J. Jacobson *In* NASA. Langley Research Center, Langley Station, Va. Collected Papers on Instability of Shell Structures—1962 Dec. 1962 p 341-359 13 refs (See N63-10804 02-34)

Experimental results for 36-inch diameter honeycomb cylinders fabricated with thin (0.010-inch) aluminum faces and cores prove that it is quite feasible to stabilize thin faces so they can be loaded beyond the yield point. The effect of initial imperfections and the various modes of failure are discussed. Author

N63-10835 General Electric Co. Space Sciences Lab., Philadelphia, Pa.
THE BUCKLING OF CIRCULAR CYLINDRICAL SHELLS SUBJECT TO AXIAL IMPACT
Anthony P. Coppa *In* NASA. Langley Research Center, Langley Station, Va. Collected Papers on Instability of Shell Structures—1962 Dec. 1962 p 361-400 3 refs (See N63-10804 02-34)
(Supported by USAF Aeronautical Systems Div.)

Early experimental results on the buckling of circular cylindrical shells subject to axial impact are described. A hypothesis for the mechanism of buckling which was based on these experiments is described. The results of further experiments which were designed to test predictions from the hypothesis and which appear to verify it in several aspects are then described. Author

N63-10836 Aerospace Corp., El Segundo, Calif.
A SURVEY OF BUCKLING THEORY AND EXPERIMENT FOR CIRCULAR CONICAL SHELLS OF CONSTANT THICKNESS
Paul Seide *In* NASA. Langley Research Center, Langley Station, Va. Collected Papers on Instability of Shell Structures—1962 Dec. 1962 p 401-426 61 refs (See N63-10804 02-34)

A survey of the state-of-the-art for the stability of thin-walled conical shells is presented. Known theoretical results are summarized and compared with experiment. The shortcomings of present knowledge and recommended work for the future are discussed. Author

N63-10837 Avco Corp. Research and Advanced Development Div., Wilmington, Mass.
ELASTIC INSTABILITY OF CONICAL SHELLS UNDER COMBINED LOADING
P. P. Radkowski *In* NASA. Langley Research Center, Langley Station, Va. Collected Papers on Instability of Shell Structures—1962 Dec. 1962 p 427-440 8 refs (See N63-10804 02-34)

Criteria are presented for the elastic instability of thin, single and multilayer conical and cylindrical shells under combined axial load and external pressure. These criteria, used in design analysis, are based on theoretical results and the correlation of these results with readily available experimental data. Author

N63-10838 Cornell U., Ithaca, N. Y.
BUCKLING OF CONICAL SHELLS UNDER EXTERNAL PRESSURE
P. P. Bijlaard (Bell Aerosystems Co.) *In* NASA. Langley Research Center, Langley Station, Va. Collected Papers on Instability of Shell Structures—1962 Dec. 1962 p 441-450 18 refs (See N63-10804 02-34)

It is shown that the initial and the buckled shapes of a certain element of a conical shell can be considered as similar to those of an element of a cylindrical shell of which the radius and length are conservatively determined. It is concluded that the buckling pressure of the conical shell is equal to that of the comparable cylindrical shell. A simple method for finding the buckling pressure, if it varies along a generatrix, is also given. Author

N63-10839 Republic Aviation Corp., Farmingdale, N. Y.
AXISYMMETRIC SNAP BUCKLING OF CONICAL SHELLS
Malcolm Newman and Edward L. Reiss (New York U.) *In* NASA. Langley Research Center, Langley Station, Va. Collected Papers on Instability of Shell Structures—1962 Dec. 1962 p 451-462 18 refs (See N63-10804 02-34)
(Partially supported by Army Res. Office Grant)

Pertinent numerical results for the relaxation buckling of full cones subjected to uniform external pressure and Belleville springs deformed by axial edge loads are presented. In addition, bifurcation buckling problems are discussed. For a specific case, the existence of Friedrichs' intermediate buckling load, P_m, as applied to cones, is established. Upper and lower bounds for its value are given. Author

N63-10840 Israel Inst. of Tech., Haifa

BUCKLING OF ORTHOTROPIC AND STIFFENED CONICAL SHELLS

Josef Singer *In* NASA. Langley Research Center, Langley Station, Va. Collected Papers on Instability of Shell Structures—1962 Dec. 1962 p 463-479 21 refs (See N63-10804 02-34)
(Grant AF-EOAR-62-61)

Donnell-type stability equations for thin, circular orthotropic conical shells are presented and solved for external pressure, axial compression and combined loading. The solution is likewise applied to stiffened conical shells. Correlation with equivalent cylindrical shells yields a simple approximate stability analysis for orthotropic or ring-stiffened conical shells under hydrostatic pressure. The general instability of stiffened conical shells under hydrostatic pressure is also analyzed by a more accurate approach. Preliminary experimental results for buckling of ring-stiffened conical shells under hydrostatic pressure are presented and discussed. Author

N63-10841 Hughes Aircraft Co. Ground Systems Group, Fullerton, Calif.

ASYMMETRIC BUCKLING OF CLAMPED SHALLOW SPHERICAL SHELLS

Hubertus J. Weinitschke *In* NASA. Langley Research Center, Langley Station, Va. Collected Papers on Instability of Shell Structures—1962 Dec. 1962 p 481-490 8 refs Work carried out at Mass. Inst. of Tech. (See N63-10804 02-34)
(Supported by ONR)

In this paper, the buckling problem is reexamined by introducing asymmetric modes of deformation. The approach is to superimpose small asymmetric deflections on finite axisymmetric deflections, and to show that the symmetric states of deformation are unstable over certain ranges of load and geometry parameter. Numerical results are obtained by means of a digital computer and are compared with previous theoretical and experimental results. Author

N63-10842 California Inst. of Tech., Pasadena

ON THE INFLUENCE OF NON-SYMMETRICAL MODES ON THE BUCKLING OF SHALLOW SPHERICAL SHELLS UNDER UNIFORM PRESSURE

R. R. Parmerter and Y. C. Fung *In* NASA. Langley Research Center, Langley Station, Va. Collected Papers on Instability of Shell Structures—1962 Dec. 1962 p 491-502 19 refs (See N63-10804 02-34)
(Supported by USAF Grant)

In view of the wide discrepancy between theoretical and experimental results that still exists, the problem of buckling of shallow spherical shells under uniform external pressure is reexamined with the introduction of nonsymmetrical deflection modes. The basic idea is that, for a symmetrical shell under gradually increasing symmetrical loading, the deformation will be symmetrical up to and after buckling, but it is feasible that a nonsymmetrical mode participates in the snap-through process. Including this possibility in the governing equations may lower the theoretical buckling load. Some analytical results are presented and compared with experiment. Author

N63-10843 New York U., N. Y.

SOME RECENT RESULTS ON THE BUCKLING MECHANISM OF SPHERICAL CAPS

Herbert B. Keller and Edward L. Reiss *In* NASA. Langley Research Center, Langley Station, Va. Collected Papers on Instability of Shell Structures—1962 Dec. 1962 p 503-514 10 refs (See N63-10804 02-34)
(Supported by Army Res. Office Grant)

In the curve of pressure versus deformation for a spherical cap subjected to external pressure, P is a loading parameter and D(P) is a measure of the deformation (e.g., maximum displacement). P_L and P_U are the upper and lower buckling loads. Points on the branch OU correspond to unbuckled equilibrium states, those on the branch LN to buckled states, and those on UL to unstable states. The buckled and unbuckled equilibrium states are not "adjacent." Therefore when buckling occurs at some value of P, the shell snaps from an unbuckled state to a buckled one. The buckling process is dynamic and a complete understanding of it requires a corresponding analysis. However, a static analysis can yield a description of the mechanism which initiates or "triggers" the dynamic process and can also yield the theoretical value, say $P = P_A$, at which this occurs. Author

N63-10844 General Electric Co., Schenectady, N. Y.

COMPARISON OF EXPERIMENTAL AND THEORETICAL BUCKLING PRESSURES FOR SPHERICAL CAPS

Gaylen A. Thurston *In* NASA. Langley Research Center, Langley Station, Va. Collected Papers on Instability of Shell Structures—1962 Dec. 1962 p 515-521 12 refs (See N63-10804 02-34)

Theoretical buckling pressures for shallow spherical caps are compared with results of various experimental investigations. Classical theory for shells with an initial imperfection gives good agreement with experimental pressures. The results cast serious doubt on the validity of the equal potential energy buckling criterion for "dead-weight" loading. Author

N63-10845 Stanford U. Calif.

LOWER BOUNDS FOR THE BUCKLING PRESSURE OF SPHERICAL SHELLS

Nicholas J. Hoff and Tsai-Chen Soong *In* NASA. Langley Research Center, Langley Station, Va. Collected Papers on Instability of Shell Structures—1962 Dec. 1962 p 523-544 7 refs (See N63-10804 02-34) Previously issued as SUDAER-133; for abstract see N62-16367 16-32
(NASA Grant NsG-93-60)

N63-10846 Advisory Group for Aeronautical Research and Development, Paris (France)

INSTABILITY OF SPHERICAL SHELLS SUBJECTED TO EXTERNAL PRESSURE

Theodore von Kármán and Arnold D. Kerr (New York U.) *In* NASA Langley Research Center, Langley Station, Va. Collected Papers on Instability of Shell Structures—1962 Dec. 1962 p 545-550 (See N63-10804 02-34)
(Supported by NSF Grant)

A survey is presented of theoretical and experimental investigations of shallow, nonshallow, and complete spherical elastic shells subjected to external pressure. A simple model is discussed which contains the main features of a clamped shallow elastic cap, and which is amenable to a simple exact analysis. The suggested model consists of a bent beam clamped at the supports. It is assumed that the beam can only contract or extend except in the areas at the intersections, where it deforms only in bending. It is also assumed that the straight parts of the beam cannot buckle in the Euler sense. Author

N63-10847 David Taylor Model Basin, Washington, D. C.

A SURVEY OF RESEARCH ON THE STABILITY OF HYDROSTATICALLY-LOADED SHELL STRUCTURES CONDUCTED AT THE DAVID TAYLOR MODEL BASIN

Thomas E. Reynolds *In* NASA. Langley Research Center, Langley Station, Va. Collected Papers on Instability of Shell Structures—1962 Dec. 1962 p 551-560 12 refs (See N63-10804 02-34)

Experimental and theoretical studies have been carried out to investigate the stability of ring-stiffened cylinders and hemispherical shells under hydrostatic pressure. The use of accurately machined models has been found extremely valuable in improving the quality of experimental data, thereby permitting a more careful examination of theory. As a result, the effects of boundary conditions and other factors usually masked by the influence of structural imperfections have been clarified. Author

N63-10848 National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
BUCKLING OF A SPHERE OF EXTREMELY HIGH RADIUS-THICKNESS RATIO
Harvey G. McComb, Jr., and Wilbur B. Fichter *In its* Collected Papers on Instability of Shell Structures—1962 Dec. 1962 p 561-570 (See N63-10804 02-34)

Some buckling experiments on a complete spherical shell having a radius-thickness ratio of about 85,000 are discussed. Extremely small pressure differentials and many relatively large local imperfections were involved in these experiments. In spite of these drawbacks, the results obtained are consistent and well-defined. The test results indicate that the local initial imperfections were not as significant in their influence on the shell behavior as were such effects as overall nonuniformity of construction and loading. Author

N63-10849 Syracuse U. Research Inst., N.Y.
DEFORMATIONS AND STABILITY OF SPHERICAL SHELLS SUBJECTED TO THE ACTION OF ASYMMETRICAL LOADINGS—EXPERIMENTAL STUDY
R. M. Evan-Iwanowski *In* NASA. Langley Research Center, Langley Station, Va. Collected Papers on Instability of Shell Structures—1962 Dec. 1962 p 571-585 7 refs (See N63-10804 02-34) (Sponsored by AROD)

This paper presents the results of an experimental investigation of the deformations and stability of spherical shallow shells, subjected to asymmetrical loadings consisting of normal concentrated eccentric loads; and of normal concentrated eccentric loads superimposed upon uniform pressure in varying magnitude and order. Author

N63-10850 Syracuse U., N. Y.
EXPERIMENTAL OBSERVATIONS ON CREEP BUCKLING OF SPHERICAL SHELLS
K. N. Tong and B. L. Greenstreet (Oak Ridge National Lab.) *In* NASA. Langley Research Center, Langley Station, Va. Collected Papers on Instability of Shell Structures—1962 Dec. 1962 p 587-596 (See N63-10804 02-34)

Creep buckling experiments were performed on hemispherical shells and spherical dishes of lead, copper, and aluminum to study the mechanism of failure. The results indicate that for thin shells under moderately-high external pressure, the failure mechanism is essentially that of static instability of a configuration that is arrived at through creep. Author

N63-10851 Harvard U., Cambridge, Mass
AXISYMMETRIC DYNAMIC BUCKLING OF CLAMPED SHALLOW SPHERICAL SHELLS
Bernard Budiansky and Robert S. Roth (Avco Corp.) *In* NASA. Langley Research Center, Langley Station, Va. Collected Papers on Instability of Shell Structures—1962 Dec. 1962 p 597-606 (See N63-10804 02-34)

On the basis of nonlinear theory, the axisymmetric deformations produced in a clamped shallow spherical shell by a transient pressure loading are calculated. A criterion for dynamic buckling is suggested and used to determine critical pressures as a function of duration of loading. The results are limited to shell geometries for which axisymmetric, rather than unsymmetric, deformations control the buckling phenomenon. Author

N63-10852 Massachusetts Inst. of Tech., Cambridge
DYNAMIC DEFORMATION AND BUCKLING OF SPHERICAL SHELLS UNDER BLAST AND IMPACT LOADING
Emmett A. Witmer, Theodore H. H. Pian, and Hans A. Balmer *In* NASA. Langley Research Center, Langley Station, Va. Collected Papers on Instability of Shell Structures—1962 Dec. 1962 p 607-622 7 refs (See N63-10804 02-34)

Two types of dynamic tests on spherical shells have been conducted. One involved blast-induced dynamic buckling and permanent deformation of the shell; the other involved producting permanent deformation of hemispherical shells by projectile impact coincident with the axis of symmetry of the shell. An analysis which predicts only the axisymmetric response of the shell has been formulated. The analysis which takes into account large deflections and plastic deformations is employed to predict and compare with the experimentally observed results. Author

N63-10853 Watertown Arsenal Labs., Mass.
NONLINEAR TRANSVERSE AXISYMMETRIC VIBRATIONS OF SHALLOW SPHERICAL SHELLS
J. Connor, Jr. *In* NASA. Langley Research Center, Langley Station, Va. Collected Papers on Instability of Shell Structures—1962 Dec. 1962 p 623-642 6 refs (See N63-10804 02-34)

A system of ordinary differential equations defining the axisymmetric nonlinear dynamic behavior of a shallow shell is obtained by expanding the transverse displacement in terms of the normal modes for the linear case. This system is integrated numerically for a rectangular pulse loading, using one and two mode expansions. Also, a simple two-degree-of-freedom model for a spherical shell is proposed, and its limiting dynamic behavior investigated. Author

N63-10854 California Inst. of Tech., Pasadena
STRUCTURAL INSTABILITY OF SOLID PROPELLANT ROCKET MOTORS
Adam R. Zak and Max L. Williams *In* NASA. Langley Research Center, Langley Station, Va. Collected Papers on Instability of Shell Structures—1962 Dec. 1962 p 643-660 20 refs (See N63-10804 02-34)

A review is made of the literature pertaining to the problem of structural stability of solid-propellant rocket motors. Two aspects of this problem which so far have not received attention, are introduced and discussed. It is shown that the conditions at the ends of the propellant grain can differ sufficiently from those existing in the body of the rocket as to warrant a localized stability analysis. The viscoelastic nature of the real propellant is discussed, and the effect of viscoelasticity on the buckling phenomena is illustrated by an example. Author

N63-10855 Martin Co., Denver, Colo.
SIMILITUDE REQUIREMENTS FOR SCALE MODEL DETERMINATION OF SHELL BUCKLING UNDER IMPULSIVE PRESSURES
Arthur A. Ezra *In* NASA. Langley Research Center, Langley Station, Va. Collected Papers on Instability of Shell Structures—1962 p 661-670 3 refs (See N63-10804 02-34)

An analysis is made of the similitude requirements for scale model determination of the buckling of a thin shell structure of arbitrary shape and thickness under impulsive pressure loading, where the duration of the impulsive pressure is not short enough for it to be idealized as a pure impulse, nor long enough to be treated like a static pressure. Author

N63-10856 Watertown Arsenal Labs., Mass
STABILITY OF THIN TORISPHERICAL SHELLS UNDER UNIFORM INTERNAL PRESSURE
John Mescall *In* NASA Langley Research Center, Langley Station, Va. Collected Papers on Instability of Shell Structures—1962 Dec. 1962 p 671-692 6 refs (See N63-10804 02-34)

The stability of the toroidal portion of a torispherical shell under internal pressure is considered from the point of view of the linear buckling theory. A detailed stress analysis of the prebuckled shell is made employing asymptotic integration. The change in potential energy of the shell is then minimized using a Rayleigh-Ritz procedure for actual computation of the critical pressure. Numerical results reveal that elastic buckling may occur for very thin shells whose material has a relatively high value of the ratio of yield stress to elastic modulus. Author

N63-10857 Tokyo U. (Japan)
ON SEVERAL RESEARCH PROBLEMS OF THE INSTABILITY OF SHELL STRUCTURES
Masatsugu Kuranishi *In* NASA. Langley Research Center, Langley Station, Va. Collected Papers on Instability of Shell Structures—1962 Dec. 1962 p 693-719 19 refs (See N63-10804 02-34)

Research results obtained on the instability of shell structures, that is, the buckling strength of full, and part of, circular and plane-walled cylinders under axial compression in elastic and plastic regions and sandwich circular cylinders under axial compression and twisting moment are treated. Graphical methods for minimum weight design of sandwich cylinders are presented. Author

N63-10858 Northwestern U., Evanston, Ill.
RECENT SOVIET CONTRIBUTIONS TO INSTABILITY OF SHELL STRUCTURES
George Herrmann *In* NASA. Langley Research Center, Langley Station, Va. Collected Papers on Instability of Shell Structures—1962 Dec. 1962 p 721-730 61 refs (See N63-10804 02-34)

A review of major recent Soviet contributions to instability of shell structures is presented. Some current trends are discussed, and established programs for future research are indicated. A representative bibliography is included. Author

N63-10859 Lockheed-California Co., Burbank
A REVIEW OF SOME AVAILABLE TECHNIQUES FOR PREDICTING GENERAL INSTABILITY OF SHELL STRUCTURES
Walter J. Crichlow *In* NASA. Langley Research Center, Langley Station, Va. Collected Papers on Instability of Shell Structures—1962 Dec. 1962 p 731-741 9 refs (See N63-10804 02-34)

The reliability of past methods of prediction for the general instability of complex light-weight shell structure has been shown to be less than adequate. A brief review of available data and methods of prediction is given, including empirical and high-speed computing techniques. These latter procedures show some promise for improvement in reliability (with empirical test-based correction factors) and success in handling more complex structure (by lumped element models in finite difference numerical techniques). Two analytical methods (Van der Neut, Becker) and two semiempirical formulae (Michielsen, Ensrud) are correlated with the GALCIT test series under pure bending. In addition, shear loading test data are described and compared with numerical predictions on four highly orthotropic panels with flexible rip caps supported on rigid posts (truss-type ribs). Author

N63-10860 Douglas Aircraft Co., Inc., Santa Monica, Calif.
A DIGITAL METHOD FOR THE ANALYSIS OF LARGE DEFLECTIONS AND STABILITY OF COMPLEX STRUCTURES
Dale S. Warren *In* NASA. Langley Research Center, Langley Station, Va. Collected Papers on Instability of Shell Structures—1962 Dec. 1962 p 743-752 3 refs (See N63-10804 02-34)

The status of an extended program to develop a general digital method for geometrically nonlinear structures is reported. The program is based on the notion of superposing corrections upon the general solutions given by linear matrix methods. Thereby, full advantage is taken of the existing capability for linear analysis. The approach offers many desirable benefits, such as (1) complete generality with respect to structural geometry, boundary conditions and thermo-mechanical loading, (2) an explicit description of the effects of initial eccentricities, and (3) provisions to account for both short-time and time-dependent plasticity, and local buckling. Author

N63-10861 Grumman Aircraft Engineering Corp., Bethpage, N. Y.
NON-LINEAR SHALLOW SHELL ANALYSIS BY THE MATRIX FORCE METHOD
Warner Lansing, Irving W. Jones, and Paul Ratner *In* NASA, Langley Research Center, Langley Station, Va. Collected Papers on Instability of Shell Structures—1962 Dec. 1962 p 753-761 7 refs (See N63-10804 02-34)

The nonlinear analysis of heated cambered wings, such as might be used in advanced flight vehicles, is discussed. The approach used is equally applicable to shallow shells, the formulations of the strain-displacement and equilibrium relations being a finite element equivalent to that used by Marguerre. The solution is obtained by a combined iteration and step by step procedure utilizing a tangent flexibility matrix. Divergence in the calculations indicates that the range of stable configurations has been exceeded. Cambered plates subjected to several loadings are given as examples; for one, an exact solution is available for comparison. Author

N63-10882 Bolt, Beranek, and Newman, Inc., Cambridge, Mass.
NEW APPROACHES TO FLIGHT VEHICLE STRUCTURAL VIBRATION ANALYSIS AND CONTROL [Final] Technical Documentary Report [Feb. 1961-Jan. 1962]
Manfred A. Heckl, Richard H. Lyon, Gideon Maidanik, and Eric E. Ungar Wright-Patterson AFB, Ohio, Flight Dynamics Lab., Oct. 1962 84 p 35 refs
(Contract AF 33(616)-7973)
(ASD-TDR-62-237)

New methods are outlined for dealing with the vibration responses of complex flight-vehicle structures to local and to diffuse acoustic excitation. Energy absorption at structural joints and acoustic radiation resistance are shown to be important in establishing levels of these responses, and are investigated. An exploratory study of the damping of aircraft structural joints, and analytical investigations of the relation between structural joint absorption coefficients and loss factors are summarized. Loss factor data pertinent to two actual aircraft substructures are appended. Author

N63-10891 Illinois U., Urbana
THE INFLUENCE OF COMPRESSIVE PRESTRAIN ON THE FRACTURE TOUGHNESS OF S.A.E. 4340 STEEL
Jerome Edward Jobaris July 1962 23 p 14 refs
(Tech. Memo. 209; T&AM-219)

This paper reports the effects of one-cycle, compressive prestrains on the fracture toughness of a high yield strength 4340 steel. Tensile tests of cylindrical, circumferently notched specimens without a stress history were used to determine the K_{IC} value of this steel. Secondly, a sample of the steel was subjected to uniform compressive prestrains, machined into notched specimens, and fractured in tension. The third type of stress history consisted of subjecting a series of notched specimens of compressive loads before fracture testing. These specimens experienced a plastic prestrain in the small volume of material at the notch tip, while the central area at the notch was not plastically deformed. Author

N63-10892 Illinois U., Urbana
THE INFLUENCE OF TEMPERATURE AND STRAIN RATE ON CRACK TOUGHNESS OF MILD STEEL
Alan Kent Shoemaker Nov. 1962 45 p 28 refs
(Grant DA-ARO(D)-31-124-G148)
(T&AM-235)

The purpose of this report is to show, using fracture mechanics concepts, that the crack toughness values of a low carbon steel (four mild steels are examined) vary according to a parameter which predicts the yield point for different combinations of temperature and strain rate. The analysis shows that the governing factor controlling the change in K_{Ic} is the change in plastic zone size at the crack tip which changes with the yield point. The yield point is controlled by the temperature and strain rate in the form of a parameter, $T \ln A/\dot{\epsilon}$. Author

N63-10894 California U., Berkeley. Inst. of Engineering Research
ON THE MECHANICAL BEHAVIOR OF VISCOELASTIC/PLASTIC SOLIDS Technical Report No. 1
P. M. Naghdi and S. A. Murch Oct. 1962 26 p 12 refs
(Contract Nonr-222(81))
(IER Ser. 175, Issue 1)

This paper is concerned with a theory of viscoelastic/plastic solids which reduces to that of the classical (linear) viscoelasticity as one limiting case and to the (inviscid) theory of elastic/plastic solids in another. After postulating the existence of a regular loading surface in the viscoelastic-plastic state and deducing the appropriate criterion for loading, a major portion of the paper is devoted to establishing (1) the convexity of the loading surface, (2) the direction of the plastic strain rate vector in stress space, and (3) the structure of the constitutive equations for the plastic strain rates. Author

N63-10898 National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio

PRELIMINARY INVESTIGATION OF EFFECT OF HYDROGEN ON STRESS-RUPTURE AND FATIGUE PROPERTIES OF AN IRON-, A NICKEL-, AND A COBALT-BASE-ALLOY

Stanley J. Klima, Alfred J. Nachtigall, and Charles A. Hoffman Washington, NASA, Dec. 1962 36 p 16 refs
(NASA-TN-D-1458) OTS: $1.00

Hollow specimens of A-286, Inconel 700, and S-816 alloys were tested in axial tensile fatigue and stress rupture while hydrogen gas was forced through them. The tests were repeated with air as the internal gas. In both types of tests, the specimen outer surface was exposed to a normal air atmosphere and a heat source. Test temperatures were 1200° F for A-286 and 1500° F for Inconel 700 and S-816. The average fatigue lives of all the alloys and the average stress-rupture lives of A-286 and Inconel 700 were neither significantly increased nor decreased due to the hydrogen environment compared with the average lives obtained with air tests. S-816 provided significantly lower average stress-rupture lives in hydrogen tests than in air tests. Author

N63-10907 Aeronautical Research Labs., Melbourne (Australia)

THE RESIDUAL STATIC STRENGTH OF STRUCTURES CONTAINING CRACKS

G. C. Lacey Apr. 1962 64 p 30 refs
(ARL/SM-288)

The fundamentals of the mechanics of cleavage fracture and fracture in metals, as presented in a number of recent articles, is first discussed. Although the fracture of metals is not yet fully understood, it is possible in the case of damaged specimens having certain standard configurations to specify simple working criteria for failure. Author

N63-10908 Republic Aviation Corp., Farmingdale, N. Y.

THERMO-STRUCTURAL ANALYSIS MANUAL [Final] Technical Report

M. J. Forray, M. Newman, and H. Switzky Wright-Patterson AFB, Ohio, Flight Dynamics Lab., Oct. 1962 213 p 21 refs For Vol. I see N62-17184 18-32
(Contract AF 33(616)-6066)
(WADD-TR-60-517, Vol. II)

Beam columns with axial end restraints and end loads coupled with transverse load and temperature gradients through the depth are analyzed. Nondimensional curves are presented for the approximate analysis of the buckling and load determination of restrained columns with eccentricities induced by mechanical loads and thermal environment. Large deflections of axially restrained, heated and loaded circular plates are treated. The general equation for linear thermoelastic analysis of axisymmetric shells is developed. Cylinders and cones are discussed. Author

N63-10915 Aeronautical Systems Div. Metals and Ceramics Lab., Wright-Patterson AFB, Ohio

THE EFFECT OF AEROSPACE ENVIRONMENTS ON VIBRATION DAMPING TECHNIQUES AND MATERIALS

D. M. Forney and W. J. Trapp *In* Soc. of Aerospace Mater. and Process Engr. National Symp. on Effects of Space Environment on Materials, St.Louis, May 7, 8, and 9, 1962 24 p 19 refs (See N63-10912 02-01)

Since an optimized damping system involves the effective coupling of both metallic materials of vehicle construction and viscoelastic damping polymers, any detrimental effect of space environments on the properties of either will seriously reduce the strength of the damping system as a whole. This is shown to be the case with each of the environmental parameters of concern. The seriousness of this problem is discussed and indications of what the outlook involves are given. Author

N63-10943 Southampton U. (Gt. Brit.)

EFFECT OF RANDOM LOADING ON THE FATIGUE LIFE OF ALUMINIUM ALLOY L.73

M. T. Lowcock and T. R. G. Williams July 1962 26 p 8 refs (AASU Rept. 225)

An axial-loading resonance rig has been designed for studying the fatigue strength of L.73 aluminum alloy under variable loading conditions. The results show that an accurate estimate of the fatigue life can be obtained from the S/N curve of the material and the RMS of the stress pattern. The S/N curve shows a discontinuity at approximately $16 T/in^2$, and the shape of the variable-loading fatigue graph is modified by this discontinuity. Author

N63-10949 Bolt, Beranek, and Newman, Inc., Cambridge, Mass.

RESPONSE OF RIBBED PANELS TO REVERBERANT ACOUSTIC FIELDS

Gideon Maidanik Repr. from J. Acoust. Soc. Am., v. 34, no. 6, June 1962 p 809-826 14 refs
(NASA Contract NASr-47)

A statistical method for estimating the response of ribbed panels to acoustic excitation is discussed. It is shown that the acceleration spectrum of the vibrational field is related to the pressure spectrum by a coupling factor which is a simple function of the radiation and mechanical resistance of the structure. The radiation resistance of a ribbed panel is studied as a function of frequency. The analysis predicts that ribbing increases the radiation resistance of the panel and hence its coupling to the acoustic field. The effect of various panel-rib boundary conditions is also considered. The results of experiments which were conducted to test the theory are reported. The agreement between theory and experiments is shown to be satisfactory. Author

N63-10967 National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

A CRITICAL REVIEW OF EXPERIMENT AND THEORY FOR FLUTTER OF AERODYNAMICALLY HEATED PANELS

Lawrence D. Guy and Sidney C. Dixon Oct. 1962 47 p 17 refs For presentation at the AFOSR and GE Symp. on Dynamics of Manned Lifting Planetary Entry, Philadelphia, Oct. 29-31, 1962
OTS: $4.60 ph, $1.61 mf

The basic equations of motion for flat, rectangular isotropic and orthotropic panels, including the effects of thermally induced midplane stress and using simple "piston" theory, are considered. In addition, the effects of flow angularity on flutter characteristics of orthotropic panels are treated. Exact and modal solutions are employed to illustrate the relations between panel vibration, buckling and flutter characteristics, and, in some cases, the effects of aerodynamic and structural damping on flutter. Theoretical results are compared with available experimental data for aerodynamically heated flat, rectangular isotropic panels and for orthotropic panels oriented at various angles to the flow direction. Author

N63-10987 National Aeronautics and Space Administration, Washington, D. C.

ON SCALING LAWS FOR MATERIAL DAMPING

Stephen H. Crandall (MIT) Dec. 1962 25 p 8 refs
(NASA-TN-D-1467) OTS: $0.75

Similarity analyses are made to provide scaling laws which indicate the effects of amplitude, frequency, and material properties on the resonant damping experienced by structural elements when the damping is due to internal material properties. Two nonlinear damping "laws" are considered. Correlations provided by the scaling laws were performed on data from a large number of tests with steel, brass, and aluminum cantilever beams. Author

N63-10990 Catholic U. of America, Washington, D. C.
FREE TRANSVERSE VIBRATIONS IN AN INFINITELY-LONG, LAYERED ELASTIC CYLINDER Technical Report No. 3
J. H. Baltrukonis, Michael Chi, and W. G. Gottenberg (Space Technology Labs., Redondo Beach, Calif.) Aug. 1962 33 p 8 refs
(NASA Grant NsG 125-61(Suppl. 1-62))
OTS: $3.60 ph, $1.25 mf

It is the purpose of this paper to derive the frequency equation for the infinitely-long, elastic, two-layered, composite cylinder and to analyze its branches in a few restricted cases. From a complete analysis of the branches of the frequency equation, it may be possible to establish the conditions under which the core- and tank-modes may be considered weakly coupled and, consequently, the conditions under which we may expect to obtain reasonable estimates of the frequencies of the coupled modes by considering the two simpler models. Author

34 STRUCTURAL DESIGN

Includes: structural elements; and weight analysis.

For related information see: 02 Aerodynamics of Bodies, Combinations, and Internal Flow; 03 Aerodynamics of Wings and Control Surfaces; and 33 Stresses and Loads.

N63-10645 Lockheed Missiles and Space Co., Sunnyvale, Calif.
STRENGTH, EFFICIENCY, AND DESIGN DATA FOR BERYLLIUM STRUCTURES Technical Report [Feb. 1960-Dec. 1961]
Robert F. Crawford and A. Bruce Burns Wright-Patterson AFB, Ohio, Flight Dynamics Lab., Feb. 1962 511 p 15 refs
(Contract AF 33(616)-6905)
(ASD-TR-61-692) OTS: $7.00

This report presents information based on studies and tests showing that beryllium now may be designed with confidence into many types of load-carrying structures, using well-known methods of structural analysis and appropriate margins of safety. Author

N63-10669 California U., Berkeley. Inst. of Engineering Research
ON THE METHOD OF GREEN'S FUNCTION IN THE THERMOELASTIC THEORY OF SHALLOW SHELLS
R. P. Nordgren Aug. 1962 43 p 23 refs
(Contract Nonr-222(69))
IER Ser. 131, Issue 16)

The method of Green's function is applied to the quasi-static thermoelastic theory of shallow shells with heat-conduction equations included. Solution formulas are derived for middle-surface displacements and stress and temperature resultants in terms of initial and edge temperatures, internal heat sources, ambient temperatures at the upper and lower surfaces, and surface tractions. Equations are given for the Green's functions appearing in the solution formulas. Extension to more general shell theory is discussed. By way of example, the method is applied to thermoelastic problems for two classes of shallow shells. Also, the effect of transverse shear deformation is examined with reference to a shallow spherical shell. Author

N63-10722 Illinois U., Urbana
ANALYSIS OF MISSILE LAUNCHERS. PART M_1. A TWO POINT MASS MOVING ON A FLEXIBLE BEAM
C. C. Fretwell Mar. 1962 43 p
(Contract DA-11-070-508-ORD-593)
(T&AM-214)

An approximate analysis is made of the motion of a flexible launcher rail which is supported by a flexible understructure and is loaded by a missile with a two-point contact which moves across the rail under the action of a prescribed thrust force. A pair of coupled integral equations are obtained which define the motion of the missile, and a numerical technique of integration is developed for their solution. Author

N63-10749 Systems Technology, Inc., Inglewood, Calif.
ANALYTICAL STUDY OF APPROXIMATE LONGITUDINAL TRANSFER FUNCTIONS FOR A FLEXIBLE AIRFRAME [Final] Technical Documentary Report [Nov. 1, 1960-Feb. 15, 1962]
B. F. Pearce, W. A. Johnson, and R. K. Siskind Wright-Patterson AFB, Ohio, Flight Control Lab., June 1962 114 p 9 refs
(Contract AF 33(616)-7657)
(ASD-TDR-62-279)

This report presents results of a study on elastic-airframe dynamics that are important from the standpoint of flight-control-system design. Approximate transfer functions are given in literal terms for three classes of vehicles. These are of such a form that the important poles and zeros are related directly to simple functions of aerodynamic, elastic, and inertial properties. The aeroelastic corrections, required to account for the flexibility influences of all modes not included in the equations of motion, are discussed and a rigorous method for applying these corrections is presented. Author

N63-10804 National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
COLLECTED PAPERS ON INSTABILITY OF SHELL STRUCTURES—1962
Washington, NASA, Dec. 1962 757 p 575 refs A collection of papers presented at the NASA SYMPOSIUM ON INSTABILITY OF SHELL STRUCTURES, Langley Research Center, Oct. 24-25, 1962
(NASA-TN-D-1510) OTS: $8.00
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N63-10805 Douglas Aircraft Co., Inc., Santa Monica, Calif.
SHELL INSTABILITY PROBLEMS AS RELATED TO DESIGN
Lewis H. Abraham and Mortimer J. Lowy *In* NASA. Langley Research Center, Langley Station, Va. Collected Papers on Instability of Shell Structures—1962 Dec. 1962 p 1-9 7 refs (See N63-10804 02-34)

A presentation is made which highlights several current shell stability problems. A searching reappraisal of shell stability research is advocated in the light of the current rapidly mounting intensity of shell research which in many cases is disproportionately academic and nondesign orientated. Author

N63-10806 Catholic U. of America, Washington, D. C.
STABILITY PROBLEMS IN MISSILE STRUCTURES
Richard J. Sylvester *In* NASA. Langley Research Center, Langley Station, Va. Collected Papers on Instability of Shell Structures—1962 Dec. 1962 p 11-20 (See N63-10804 02-34)

A number of specific buckling problems relating to missile propellant tanks and transition sections are enumerated. In some cases approximate techniques used by missile designers to determine stability are mentioned. The inadequacies of these approximate methods and the unavailability of appropriate usable information are stressed. Furthermore, the mathematical complexities of nonlinear buckling problems are considered. Some possibly fruitful areas of mathematics to simplify these complexities are discussed with the hope that research in these areas will provide a better means through which the analyst may supply the designer with more realistic and accurate theoretical data. Author

N63-10807 Space Technology Labs., Inc., Redondo Beach, Calif.
SOME TYPICAL SHELL STABILITY PROBLEMS ENCOUNTERED IN THE DESIGN OF BALLISTIC MISSILES
A. Kaplan, E. J. Morgan, and W. Zophres *In* NASA. Langley Research Center, Langley Station, Va. Collected papers on Instability of Shell Structures—1962 Dec. 1962 p 21-33 4 refs (See N63-10804 02-34)

Investigations carried out on three current problems involving instability of thin shells in applications to aerospace vehicles are discussed. The first concerns the experimental determination of the buckling behavior of longitudinally stiffened pressurized cylinders; the second, the analytic prediction and experimental confirmation of the buckling behavior of multilayer cylinders; and the third involves the behavior of cylinders under combined axial load and lateral pressure. It is indicated that the longitudinally stiffened cylinder shows considerable promise in taking maximum advantage of the strengthening effect of internal pressure, that the use of an external low modulus layer as an insulator can have a significant effect on the buckling capability of a shell, and that the assumption of a linear interaction for pressure and axial load is unnecessarily conservative. Author

N63-10808 Lockheed Missiles and Space Co., Sunnyvale, Calif.
SOME SHELL STABILITY PROBLEMS IN MISSILE AND SPACE VEHICLE ANALYSIS
D. O. Brush *In* NASA. Langley Research Center, Langley Station, Va. Collected Papers on Instability of Shell Structures—1962 Dec. 1962 p 35-44 12 refs (See N63-10804 02-34)

A brief discussion is presented of three structural shell stability studies in progress. These are: the stabilizing influence of solid propellants, the effect of cushion stiffness on buckling under cushion loading, and the snap-through buckling of axially loaded cylinders. Recent analytical results are compared with test data. Author

N63-10809 General Dynamics/Astronautics, San Diego, Calif.
DEVELOPMENT OF DESIGN STRENGTH LEVELS FOR THE ELASTIC STABILITY OF MONOCOQUE CONES UNDER AXIAL COMPRESSION
A. H. Hausrath and F. A. Dittoe *In* NASA. Langley Research Center, Langley Station, Va. Collected Papers on Instability of Shell Structures—1962 Dec. 1962 p 45-56 9 refs (See N63-10804 02-34)

Design relationships have been derived for the determination of elastic buckling strength levels for unpressurized monocoque truncated cones under axial compression. Theoretical implications have been considered in the establishment of a semi-empirical analysis leading to the development of probability based design expressions. Data from 170 tests by various investigators were statistically evaluated for the expected mean, 90%, and 99% probability strength levels. Dispersion of data was found to be slightly less than that of monocoque cylinders. Non-linear effects of radius-to-thickness ratio or strength deterioration with length-to-radius ratio were not discernible. Author

N63-10810 National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
SHELL STABILITY PROBLEMS IN THE DESIGN OF LARGE SPACE VEHICLE BOOSTERS
James B. Sterett, Jr. *In* NASA. Langley Research Center, Langley Station, Va. Collected Papers on Instability of Shell Structures—1962 Dec. 1962 p 57-66 6 refs (See N63-10804 02-34)

A discussion of the current methods used to design the Saturn type booster shell structures is presented covering bending and axial compression, with and without internal pressure. Problem areas encountered in the application of available shell stability data to these designs are delineated, as well as suggested areas of future research for shell configurations anticipated in advanced designs. Author

N63-10811 General Dynamics/Fort Worth, Tex.
PROBLEMS ASSOCIATED WITH THE DESIGN OF LARGE SHELL STRUCTURE
W. M. Moseley *In* NASA. Langley Research Center, Langley Station, Va. Collected Papers on Instability of Shell Structures—1962 Dec. 1962 p 67-76 6 refs (See N63-10804 02-34)

An account of the approach used in design of a large sandwich-construction nose cone is given. The areas in which analytical methods are needed are discussed and a theoretical procedure is proposed. Author

N63-10812 Martin-Marietta Corp. Space Systems Div., Baltimore, Md.
DESIGN OF STIFFENED CYLINDERS IN AXIAL COMPRESSION
John M. Hedgepeth *In* NASA. Langley Research Center, Langley Station, Va. Collected Papers on Instability of Shell Structures—1962 Dec. 1962 p 77-83 5 refs (See N63-10804 02-34)

The problem of optimum design of axially compressed cylinders stiffened by rings and stringers is discussed. Particular attention is devoted to configurations suitable for large launch vehicles. Consideration is given to the analytical techniques for determining strength as well as the procedures for optimization. Author

N63-10813 North American Aviation, Inc., Los Angeles, Calif.
ELASTIC STABILITY CONSIDERATIONS IN AIRCRAFT STRUCTURAL DESIGN
Richard I. Schleicher *In* NASA. Langley Research Center, Langley Station, Va. Collected Papers on Instability of Shell Structures—1962 Dec. 1962 p 85-94 2 refs (See N63-10804 02-34)

General instability in shell-type structures is a relatively infrequent phenomenon. By general instability is meant that a complete section of a structure becomes elastically unstable, as compared with local crippling or buckling. The first step in design is to rough size the structure and determine its compatibility with air-vehicle configuration and systems installations. After this step has been completed, it

is possible to survey the layouts to determine whether general instability is likely to occur. The general parameters of length, diameter, frame spacing, element stiffness, etc., are then investigated to determine if a general failing stress exists which is less than any local column, beam column, or panel failing stress. In this way, a well-balanced design is determined and general stability failing modes eliminated. Author

N63-10951 Astro Research Corp., Santa Barbara, Calif.
THEORETICAL AND EXPERIMENTAL STUDIES OF EXPANDABLE STRUCTURES Summary Report
H. U. Schuerch Oct. 9, 1962 13 p 6 refs
(NASA Contract NASr-8, Amend. 1)
(ARC-R-77) OTS: $1.60 ph, $0.80 mf

A study is made to ascertain the effects of external loading upon pressure-stabilized expandable structures, the effect of centrifugal forces upon filament-wound pressure vessels, and the packaging problem associated with the folding mechanisms of thin-walled shell structures of an expandable nature. The analysis indicated that the shearing deformation was predominant and that the shearing stiffness was essentially equal to the cross section times the internal pressure, thus confirming the theorem that the internal pressure assumes the role of the shear modulus. Analytical expressions are formulated for axisymmetric, rotating filament-wound pressure vessels, in terms of tabulated elliptical integral functions. Anisometric mapping technique is used for the analytic treatment of folding deformations. J.R.C.

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